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THE USE OF THE FLICKER PHENOMENON IN THE INVESTIGATION OF THE FIELD OF VISION*

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FOLLOWING upon the extensive use of the flicker phenomenon made by Granit in psycho-physiological visual investigations, Phillips[17] attempted to use the same method for recording the visual field defects in cases of intracranial tumour. His paper described only a few cases, and the work was intended purely as a trial of a new clinical method.

As a direct continuation of Phillips's work, further attempts have been made to utilise his method both in its original form and in modifications (see Appendix). These modifications were evolved, and used or rejected from time to time during the course of the regular investigation of the visual fields of suitable cases coming into the Neuro-surgical Department of the London Hospital, so that the whole work may conveniently be considered in two parts. First, the modifications and the reasons for trying them; and secondly, the conclusions to be drawn from the flicker investigation of fifty-eight cases having actual or possible visual field defects.

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I. RATIONALE OF THE METHOD.

If a person views an intermittent light, it may appear to flicker or to be steady, according to the rate of interruption. It is possible to find, for any one set of conditions, a rate of interruption which is only just visible as flicker; and this rate is what is usually meant by the term "fusion frequency," expressed as flashes per second. The fusion frequency may be altered, not always by decrease, in any condition giving decreased visual perception ([2, 5, 22]) and Phillips attempted to make use of this fact in investigating visual fields.

II. DIFFICULTIES IN USING THE METHOD.

The finding of the fusion frequency is not easy, and many people, even those with some experience in forming critical judgments, find great difficulty, at least at first, in deciding upon the presence or absence of flicker when the rate is only two or three flashes per second below the fusion point. In using flicker in field-taking this relatively large error is of little importance in cases of well-marked scotoma; but it was rather in the cases of slight or doubtful field defects that most was expected from the method (Phillips [17]). Usually, though by no means always, practice improves the judgment of flicker; but there is little opportunity to give practice during the investigation of a patient, especially if that patient be sufficiently ill to be exhausted by sitting rigidly in a chair for half an hour. This difficuty in making a critical judgment is not so great at and near the centre of the field as it is 30 degrees or more in the periphery. This no doubt explains why Teräskeli[22] found that patients of all kinds learnt fairly readily to give concordant results, for she was concerned with points no further than 10 degrees from the centre of the field. In the present investigation, concerned as it was for the most part with cases of intracranial tumour, it was necessary to examine as much as possible of the whole visual field. In practice, both Phillips and I were quite unable to obtain reliable readings beyond the forty degrees isopter.

In addition to the difficulty of persuading some people to give an opinion at all, certain curious effects appeared sufficiently often to become recognised as annoying sources of error. Why, for instance, should a person, during the course of an experiment under constant conditions suddenly give readings five or ten flashes per second above or below the previous ones? A fall in the readings may be attributed to persistent local adaptation perhaps (Granit and v. Ammon,[7] Riddell,[18]); but it will be shown later that that factor can largely be eliminated. More probably true fatigue and loss of interest and attention are the cause. But it is more difficult

to explain a sudden rise, a rise that is too sudden to be due to light adaptation. It may be that in some way the visual apparatus becomes more sensitive to flicker. But on the other hand, Granit and Riddell[10] remarked apparently spontaneous flicker waves in the frog's retinal action potential just after cessation of a flicker stimulus; and Granit and Therman,[12] attribute these to synchronised optic nerve discharges. The writer has himself noticed that after repeated observations of flicker the stimulated area may continue to present fine flicker, even when the gaze is directed elsewhere. Such a happening would account for the seeing of flicker at unusually high rates, the flicker waves being due not to the interruptions in the light but to spontaneous synchronised retinal neurone activity left over from a previous stimulus.*

One patient was noteworthy in that he showed suddenly during an experiment an almost exact halving of his fusion frequency; and this is particularly interesting in view of the fact that Granit and Riddell[11] occasionally found a frog's eye to respond to flicker with waves at half the frequency of the stimulus. Granit and Therman[12] have recently confirmed this finding, although they attribute it to the presence of alternate large and small responses rather than to the complete failure of every second response.*

Another big drawback of flicker as an instrument for measuring the visual fields, is its cumbersome nature. The method of recording most often used was the usual one of " sampling," where, by repeated short exposures of about 1·5 seconds' duration, the rate is found at which flicker is just perceptible. Even a practised observer will require on an average six observations to establish a value (*cf.* Lythgoe and Tansley[16]), and that means at least two hundred observations in order to get the bare skeleton of a field from the centre out to 40 degrees. This is quite a heavy task to impose upon even a healthy person at one sitting; and since the values given by the same person appear sometimes to vary a little from hour to hour, due probably to fatigue and perhaps to other factors [20], the field ought obviously to be completed at one sitting if possible. A striking instance of the effects of fatigue was given by one control (K), who, between two sets of readings, had had a sleepless night; the second readings were definitely lowered, and were much more variable.

* In a more recent paper (*Jl. Physiol.*, Vol. LXXXV, p. 421), Raynor Granit has drawn a clear distinction between I-retinae (responding to flicker readily by activity of the negative or inhibition phase of the action potential, and probably always having a preponderance of cones) and E-retinae (responding by a much less active positive excitatory or *b*—component, and being typically rod-containing eyes). He suggests that in the frog's and in the human eye, which have " mixed " retinae, the flicker response may be an algebraic sum of the two types of response, and thus more liable to unexpected changes in values. He mentions in another paper (see footnote, p. 395) that clinical evidence in support of this theory is forthcoming.

This great objection of the time factor and of fatigue led to the trial of the " falling " method, whereby the flicker, starting at a rate that is definitely fused, is slowed steadily and fairly rapidly until it is appreciated as flicker. This method, if reliable, would enable each value to be ascertained in, at the most, three readings. But it leads to trouble from the well-known phenomenon (investigated by Granit and v. Ammon[7] and by Riddell[18]) that steady observation of fast flicker will, especially at the periphery, rapidly lead to its becoming fused. This effect is usually called " local adaptation to flicker," and in using the "falling" method it very often happens that the rate of this local adaptation is faster than any rate of " falling " that is consistent with the patient's reaction time; so that adaptation to the flicker would keep just ahead of actual perception, and the " falling " method would give a reading lower than that obtained by " sampling." The method was therefore abandoned.

Local adaptation to flicker also tends to give trouble with the " sampling method "; for many people cannot give a judgment from an exposure of only 1 to 1·5 seconds, which for physiological reasons is the optimum[7,8,9]. This trouble was, however, finally avoided to a large extent by arranging, by means of a system of mirrors, for parallel beams of light, one steady and the other flickering, but both of an apparent equal brightness (Riddell[18]). The test patch could be illuminated by either beam, and the change from one to the other was made with a minimum of perceptible alteration in the field (Fig. 2B). In this way it was possible to make an area of light of a certain size and brightness suddenly commence flickering at any pre-selected rate. It was found that the preliminary steady light caused no local adaptation to subsequent flicker, so that the observation could usually be made without giving local adaptation time to produce any appreciable drop in the flicker fusion rate; and even when local adaptation to flicker had occurred it could rapidly be abolished, without otherwise altering the appearance of the field of vision, merely by reverting to the steady light for a few seconds.

The special advantages of this mirror method are these: 1. It eliminates some of the difficulty caused by local adaptation to flicker. 2. It allows of modification in the procedure, so that blackness, steady light or flicker can be presented at will without readjustment of the apparatus. This is particularly useful, for instance in cases of low macular acuity (*v. inf.*) 3. It abolishes the need for a shutter, which is noisy and also tends to produce stroboscopic effects. ([16]). 4. If a white test screen is used and the test patch when flickering fast is made to match the screen in brightness, the patient need receive no warning whatever of when flicker should appear. This

state of affairs appears to me particularly important for the following reason. It is easily demonstrated even in the normal subject that the visual field for small movements and small objects can be increased by informing him where to expect the object or movement to appear (*cf.* Grindley[13]). Hence it is not surprising that a slight defect in an otherwise normal field can often be demonstrated only when the patient is given no warning of where and when to concentrate. The defect, in other words, is one of visual attention rather than a definitely scotomatous area.

That the mirror method was likely to be suitable for the purpose was realised first of all during consideration of the probable human retinal potentials evoked under different conditions. The work of Granit and his helpers[3], of Hartline[14], and of Sachs[15,21], has shown that human potentials are similar in behaviour to those of many other vertebrates; so the gaps in our knowledge of the human ones may be filled from the behaviour of those of other animals.

Fig. 1A shows the type of response to a short series of flickers in the frog's light adapted eye (Granit and Riddell[10]). The most marked parts of the whole response are at " on " and " off "; and indeed some patients have apparent difficulty in dissociating the onset and cessation of a short stimulus from the rhythmic stimulus of flicker. If, however, the flicker be made to appear in an area already stimulated by a light of equal brightness (mirror method)

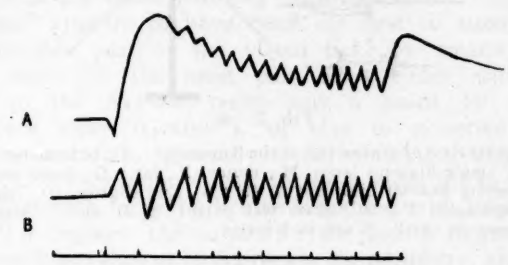

FIG. 1.

A Retinal potentials in response to short series of flickers preceded by darkness. (Slightly diagrammatic for comparison with B). Instrument, string galvanometer. *B* Tracing, under somewhat greater sensitivity, of flicker preceded by steady light. Instrument, oscillograph. Frog. Time, 1/5 secs.

I have found the response to as in Fig. 1,B. Here the only result of the altered stimulus is that due to the flicker, and if the flicker is too fast to be perceived, there is no additional stimulus received at all. If then the test light is made to match the surrounding screen, there should be practically nothing perceptible to the

patient on the screen unless flicker appears at a rate below his fusion frequency at the time. Thus full advantage can be taken of any " visual inattention " there may be; and in addition after-images are avoided. It might be thought that the lack of constrast between the flicker and the screen would make it more difficult to see; but this is not so. Contrast has much less influence than might be expected when the surroundings are sufficiently bright to maintain a fair degree of light adaption (Lythgoe and Tansley[16]).

III. ARRANGEMENT OF APPARATUS.

In the appendix are given details of the various modifications of the apparatus. They are denoted in the text by symbols (e.g. A III). Fig. 2A shows the plan of Phillips's set-up (A I); and Fig. 2B shows my final modification (mirror method, C III), which in my hands gave readily the most sure results. Phillips had worked at one metre with the idea of getting more detail, as

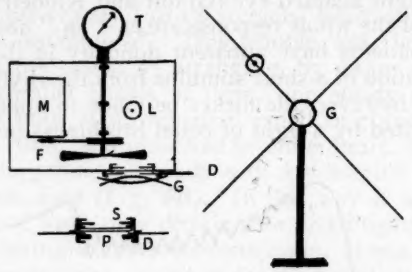

FIG. 2. *A*.

Phillips's Apparatus (AI of the Appendix). T., tachometer; L., single filament lamp; M., motor; F., fan; G., frame for carrying fixation discs out to 40°; S., Luc shutter; D., iris diaphragm; P., milk-glass test patch. S. D. and P. also shown in detail. Used at 1 metre.

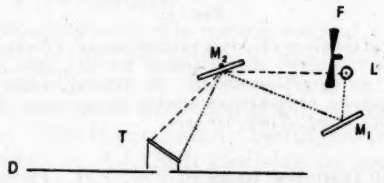

FIG. 2. *B*.

The Mirror Method (CIII of the Appendix). L., single filament lamp; F., fan; M1, fixed plane mirror; M2, plane mirror on vertical axis; T., opal glass test patch; D., white screen of 30° area with central aperture. Used at 0·5 metre.

in campimetry. But, as explained below, fine detail of contours cannot be expected from this method, so there is no disadvantage in using a small screen (as in C III) provided a chin and forehead rest is used. The great advantage of the small screen is that it enables the experimenter to see the patient and to check his fixation, a very necessary feature, as it was almost certain that many of the earlier conflicting readings were due to eye movements. With the small screen, indeed, it became apparent that probably quite 50 per cent. of the patients could not be trusted to use careful fixation unless they were constantly checked.

It may be noted here that Granit[6], and also Teräskeli[22], used short distances and small screens. The principal differences between their arrangements and mine were that they used flicker at a greater intensity than the surroundings, and that they used a shutter.

The Value of Flicker in Investigating Visual Fields

A. FLICKER IN THE NORMAL SUBJECT.

Certain facts about the normal flicker values in different parts of the retina must be understood before a criticism of the results in lesions of the visual pathway can be effective.

Phillips[17] appears to have been the first to attempt to map a considerable part of the visual field by means of flicker. Earlier work for the most part dealt either with readings limited to the fixation point and a point 10 degrees or 20 degrees away (Granit[6,9]), or else to a series of points along one meridian, generally a horizontal one (Lythgoe and Tansley[16]). Observations made in these ways led to the general finding that with fairly high intensities and with areas of flicker of over 1·5 degrees, the values for the fusion frequency at the centre were lower than at 10 degrees in the periphery, and that from the 10 degree mark outwards the values gradually fell (Fig. 5A), cf. Creed and Ruch[4]). This peak value at about 10 degrees is considered to be due to the junction of the macular area and its even number of cones and ganglion cells with the periphery, where there are many rods and cones to each ganglion cell, as well as a profuse synaptic network. The readings obtained from a case of retinitis pigmentosa (with hemeralopia) seem to confirm this idea. They are shown in Fig. 3, compared with similar readings from a control. Although the patient had fields out to 30 degrees for 10/330 white, the flicker-values drop rapidly from the centre owing, presumably, to involvement of the intraretinal

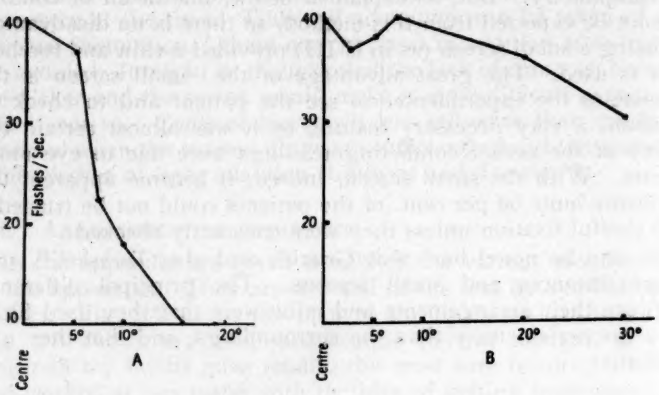

FIG. 3.

A Case of retinitis pigmentosa, with retention of fields for 1/330 white out to about 30°. Flicker conditions B V ; aperture 2°.
B Normal control (K) with full fields to 1/330 white. Flicker conditions similar. Unusual detail of values near the fixation point obtainable with this observer.

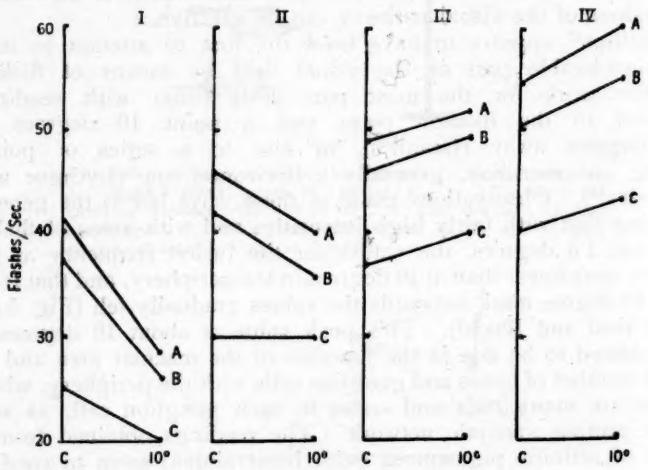

FIG. 4.

Condition AIII. Normal subject R. In each set the letters A, B and C denote values with the flicker at 14 equiv.f.c., 5 equiv. f.c., and 1 eqiv. f.c. respectively. I is with aperture 30 min., II is with 1°, III with 2°, IV with 3°.

synapses (But *cf.* inf. and [5]). However, the degree of development of this " peak " necessarily varies, as already stated, with the intensity and area used. Fig. 4 shows a series of actual values from the same normal subject under different conditions. From this it will be realised that flicker readings are essentially relative, and that external conditions must be rigidly controlled. The values shown were obtained with a black background; if this were white and subjected to varying degrees of illumination, the changes in the values would be still more involved.

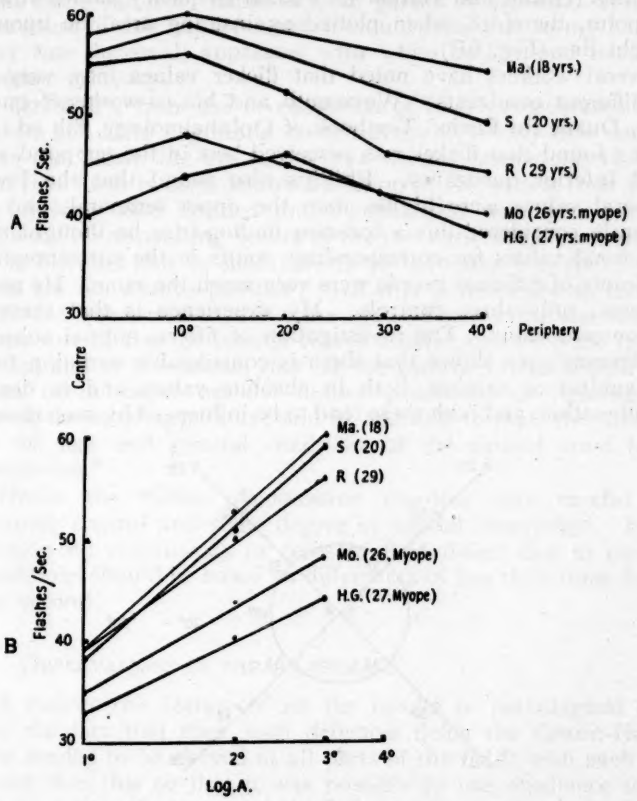

FIG. 5.

A Variations in fusion frequency for a 3° aperture under AIII conditions in five normal controls. The abscissae represent points in the field.

B Values for the same five controls at 10° in the periphery, showing the summation due to replacing a 1° aperture by a 2° and a 3° aperture (n = a log A plus b.).

Another effect noticed by all observers was that the larger the area of flicker the higher the fusion frequency (*see* Fig. 4); and Granit and Harper[9] proved this to be due to a process of retinal summation mediated by the horizontal synaptic paths in the retina. As mentioned above, these path are most numerous out in the periphery, and occur not at all at the fovea. Summation is therefore greater in the periphery. It conforms to a law like the Ferry-Porter Law, *viz.*, $n = a \log A + B$, where n = fusion frequency in flashes per second, A = area of flicker, and a and b are constants (Granit and Harper[9]). Fusion frequency values at any one point, therefore, when plotted against log area, lie upon a straight line (Fig. 5B).

Several workers have noted that flicker values may vary in the different quadrants. Weymouth and his co-workers[24] quote Alex. Duane (in Fuchs' Textbook of Ophthalmology, 8th ed.) as having found that flicker was perceived best in the temporal and nasal inferior quadrants. Phillips also found that the lower temporal values were higher than the upper temporal, and he evidently considered this a constant finding; for he thought that all normal values for corresponding points in the corresponding quadrants of different people were very much the same. He used, however, only three controls. My experience is that there is no constant value. The investigation of fifteen normal subjects of different ages shows that there is considerable variation from one subject to another, both in absolute values and in degree of summation, and both these tend to be influenced by such diverse

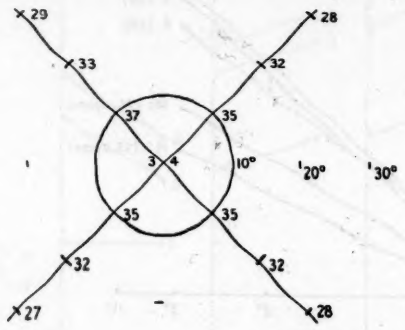

FIG. 6.

Raised values in one quadrant in a normal control (N). Conditions C III, aperture 2°. In this and subsequent diagrams the numbers represent the fusion frequency in flashes/sec.

conditions as age, myopia (Fig. 5), time of year and pulmonary ventilation ([20]). Variations between quadrants in any one eye (Fig. 6) are by no means constant in distribution, and may be absent; they are not large (1 or 2 flashes per second), and may even vary slightly in the same eye from day to day. There is, except for this, quite a close correspondence between the values in the two eyes of the same person. The greatest individual variations were noted when using the black screen; but with the small white screen the values tended to approximate more, though still being far from identical from person to person. Whatever the cause of this improvement, it would seem that in my hands at any rate the small apparatus with white background makes for greater accuracy.

Teräskeli[22], from the investigation of fusion frequencies at the centre and at 10 degrees in the periphery in twenty-nine controls, also concluded that the two eyes of normal people closely agree, but that there is considerable variation in the values from person to person. She decided that comparisons were possible only between corresponding points of the two eyes of the same person. It is obvious that in field defects comparisons between the two eyes are not always possible; so that it is necessary to compare different quadrants in the same eye. There must therefore be some sort of average normal values decided upon for use in such cases; and it is essential that all the control values should have been taken under exactly similar conditions of lighting and arrangement of apparatus; and in addition to that, the influence of the age and general condition of the patient must be remembered.*

Hence the flicker phenomenon requires very careful use, accurate control and some degree of special knowledge. In my opinion no conclusions in cases of field defect due to cerebral conditions should be based on differences of less than three flashes per second.

B. Observations in the Abnormal.

A noteworthy feature of all the results in pathological cases was the fact that even with defective fields the Granit-Harper Law tended to be obeyed at all parts of the field; with such constancy was this so that it was possible to use obedience to the law as a test of the accuracy of the readings at any one point (Fig. 7A).

*A useful summary on the known facts on flicker, physiological and pathological, has just been published by Ragnar Granit. *Acta Ophthal.*, Supplement VIII, Vol. XIV.

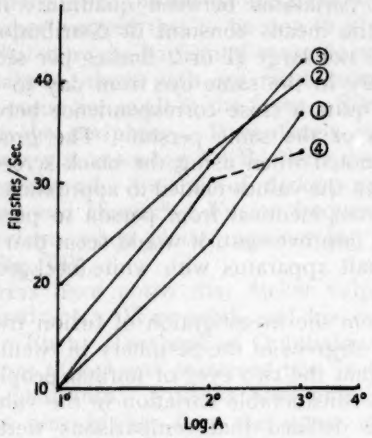

FIG. 7. *A*.

Values showing obedience to Granit-Harper law in a case (J.S.) of aneurysm of the circle of Willis producing complete left homonymous hemianopia and considerable depression of the temporal field of the right eye. All values are for 1° aperture taken at 20° from fixation point in the right temporal field. (1) Meridian 30° to right of vertical. (2) Meridian 45°. (3) Meridian 90°. (4) Meridian 135°.

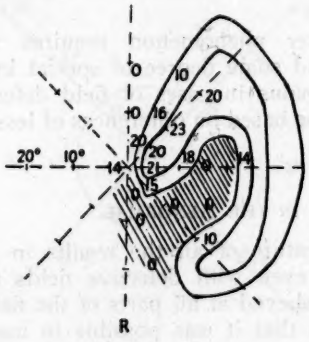

FIG. 7. *B*.

The right field of this case (J.S.) shows that the reduced value for 3° aperture in Fig. 7A (4) is due to the fact that the area tested probably overlapped the area of a dense scotoma. Isopters to 10/2000 and 50/2000. V.A. 6/36. Flicker conditions A III, aperture 1°.

There were only two apparent exceptions to be allowed for. First, where the values were all very low, the readings for small areas of flicker (30 min. to 1 degree) were often lower than the law would indicate. This, however, is quite in keeping with Granit's observation that the law is observed best with flicker fusion values of 30 to 50 per second. The other exception was that sometimes the largest areas failed to give a high enough reading; but in such cases comparison with the fields obtained with the Bjerrum screen usually showed that the area used must have overlapped into a steep-edged scotoma, and thus have had its apparent size reduced ([4] in Fig. 7A). Enlargement of the blind spot can produce a similar error, so that when only a few values can be obtained there may be the erroneous suggestion of a quadrantic defect on the tempora side.

(1) *Cases of Intracranial Lesions.*

The main object of this investigation was a further testing of Phillips's conclusion[17] that in cases of intracranial lesions of the optic pathways flicker fusion values were affected earlier and recovered more quickly than form perception. Riddoch[19] had previously concluded that there was a similar dissociation between form and movement perception in occipital injuries. If then the results of these two observers were correct, both flicker and movement should provide useful tests in early diagnosis and in post-operative prognosis; and of the two, flicker at first sight seems the better to use since it can readily be measured in definite units. The present investigation has led to the conclusion that, in general, flicker and ordinary perimetry, in which movement may form an element in the test[23], agree in their findings; but in my hands neither seems as a rule more sensitive than the other.

The work of Granit and his co-workers[10,12] upon the retinal action potentials and optic nerve potentials in flicker makes it obvious that flicker perception is distinct from steady light perception, and the two might therefore be dissociated in disease of the retina. It is possible that a similar study of potentials with vibratory movement of a light would also show a distinct difference. But it must be noted that the differences appear to arise in the retina and not in the pathways beyond. Hence there is the less reason for expecting a dissociation in cases of cerebral tumour and of occipital injury such as was described by Phillips and by Riddoch.

With the well-known dissociation of pain sense from touch, the lesions are in the spinal cord, and the syndrome occurs because the pathways are there distinct. There is no basis of comparison between the two sets of conditions.

Indeed, granted that flicker of a light or vibration of a test object produced greater stimuli than a steady light or a stationary object, there seems no reason why either should not provide as ready a means as the other of detecting small defects in the field when these are due to intracranial conditions. When they are due to retinal conditions, on the other hand, dissociation may

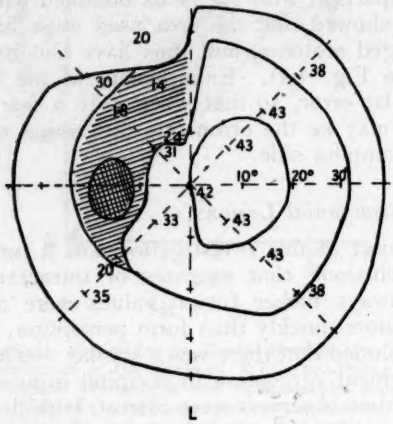

FIG. 8. *A*.

Two typical cases of agreement of perimetry and flicker. Subject J.O.H., pituitary adenoma. Isopters to 1/2000, 3/2000 and 9.5/2000. Relative scotoma to 9.5/2000. Blind spot: 50/2000. Flicker values for 4° aperture, conditions C III. V.A. 6/9 left eye.

be produced by interference with the action of the synapses and the neurones, for this interference may be selective[5].

In campimetry, vibration of a test object[22] has the advantage of requiring no special apparatus, and no special knowledge. On the other hand, flicker is capable, in a good subject, of much more accurate measurement; but this appears to be its only advantage in lesions situated beyond the retina, unless certain special aspects of it prove to have significance (v. inf.).

In the present work it has indeed been found quite exceptional for flicker to show a defect not found on the screen.

From a total of fifty-eight cases the following results were obtained:—

In forty-four there was substantial agreement between the fields by flicker and by perimetry. Two examples are given in Fig. 8.

TABLE I

Patient	Age and Sex	Date	Method	Lesion	Vision	Comparison of methods
E. B. -	33 F.	Pre-op.	B V	Probably cerebellar tumour	6/6 6/6	*Perimetry* showed only slight concentric constriction and large B.S. *Flicker* gave homonymous upper left defect. This is not a likely finding.
W. C. -	32 F.	No op.	A I	Chiasmal (? pituitary)	6/12 6/12	*Perimetry:* bitemporal restriction to small visual angles. *Flicker*: no defects. Probably wrong, and therefore less sensitive.
M. F.-	28 M.	4 years post-op.	B V	L. occip. glioma	6/6 6/6	*Perimetry:* homonymous upper right defect (very slight). *Flicker:* suggestion of upper left defect. Obviously wrong.
H. C. -	33 F.	18 mths. post-op.	B IV	Pituitary adenoma	6/9 6/9	*Perimetry:* upper bitemporal defect to 3/2000 white and to red. *Flicker:* no defect. Definitely less sensitive.
M. H. -	35 F.	Pre-op.	A II	L. olfact. groove meningioma	6/18 6/6	*Perimetry:* left shows slight upper temporal defect. *Flicker:* lower nasal defect on left. Probably wrong, though not necessarily.
M. H. -	28 F.	No op.	B V	I.C.T. suspect	6/36 6/12	*Perimetry;* upper nasal defect, left; right—both upper quadrants restricted. *Flicker:* upper bitemporal defects. This patient had no papilloedema, and there is the possibility that flicker was right, though no clinical signs to suggest a chiasmal lesion.
G. H. -	11 M.	No op.	B III	I.C.T. suspect	6/9 6/6	*Perimetry:* suggestion of upper field defects. *Flicker:* normal; there were no definite signs of a tumour, so flicker was probably right.

TABLE I—*continued*

Patient	Age and Sex	Date	Method	Lesion	Vision	Comparison of methods
J. H. -	48 M.	No op.	B IV	Headaches (origin unknown)	6/18 6/18	*Perimetry:* suggestion of upper and lower temporal defect. *Flicker:* negative (probably right).
D. J. -	40 M.	No op.	B IV	Gliosis after contusion	6/18 6/18 (not corrected)	*Perimetry:* suggestion of central relative scotomata. *Flicker:* central values normal. Flicker probably right (no central changes).
I. A. L.	51 F.	No op.	B III	? arteriosclerosis	6/60 6/24 (not corrected)	*Perimetry:* upper nasal defect in right eye only. *Flicker:* homonymous upper left decrease. This is the more attractive finding; but other investigations failed either to substantiate or to disprove it.
M. M.*	59 F.	Pre-op.	A III	Right parietal meningioma	6/9 6/18	*Perimetry:* no definite findings beyond scotoma from old retinal haemorrhage, left. *Flicker:* slight homonymous left defect. It is tempting to believe that flicker was the more sensitive here.
J. M.*	34 M.	1 year post-op.	B V	Right parietal meningioma	6/6 6/6	*Perimetry:* normal. *Flicker:* suggestion of upper left homonymous defect. Here flicker seemed definitely more sensitive.
H. P. -	48 M.	No op.	C III	I.C.T. suspect	6/6 6/8	*Perimetry:* variable. Confrontation gave "inattention in right homonymous fields." *Flicker:* right homonymous defect. Flicker seems more sensitive here.
T. W. -	65 M.	Pre-op.	C II	Carcinoma of base of skull	6/24 6/36 (not corrected)	*Perimetry:* full fields. *Flicker:* defect in upper left temporal at 20°. Due perhaps to blind spot?

* Flicker, but not campimetry, in agreement with operative findings.

In fourteen there was a disagreement between the two methods; the lesion was verified histologically in six of these cases and not verified in eight. In five of them the flicker fields were almost certainly wrong, giving very improbable defects in three cases and missing defects in two. In nine cases, however, flicker may have been the more correct, but in only two of these were the flicker findings able to be substantiated by operative findings.

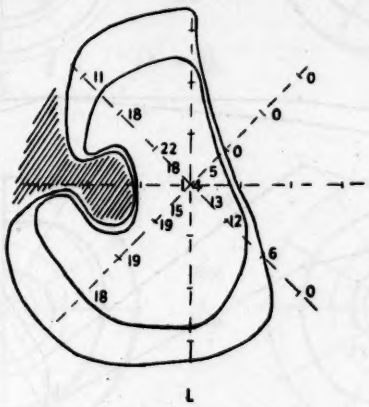

FIG. 8. *B.*

Subject A.M., temporo-occipital meningioma. Isopters to 4.5/2000 and 9.5/2000. Flicker for 4° aperture, conditions C III. V.A. (corrected) 6/9 left eye.

Table I gives a summary of the cases where there was disagreement between the methods.

In the other forty-four cases the flicker tests and perimetry gave substantial agreement. By this it is meant that flicker, in the areas of retina where it was measured, gave similar indications of normality or of defects to those which were obtained by campimetry; but in no case was it possible to do nearly so complete a field with flicker, and in some cases only a very few values could be obtained. The flicker field was always poor in contours (Fig. 8) and was never measurable beyond 40 degrees in the periphery.

As a general conclusion it may be stated then that for intracranial lesions the flicker method cannot replace perimetry in the mapping of a field. It is as a rule no more sensitive to slight defects, and it is more difficult to use. There is, however, one way in which the method may be of use in investigating field defects, and that is to employ it for more accurate measurement of the density of relative scotomata. Though it can show

their boundaries only roughly, it can give in arithmetical units a more definite value for such relative blindness. With the screen it may be found, for instance, that a scotoma on one occasion is at its centre quite blind to white 5/2000, while on another occasion this size of object can be seen if it is agitated. This is only a very indefinite measure, and flicker can do better; for the change may be expressed as an improvement from a fusion frequency of, say, 30 flashes per second, to one of 36 flashes per second.

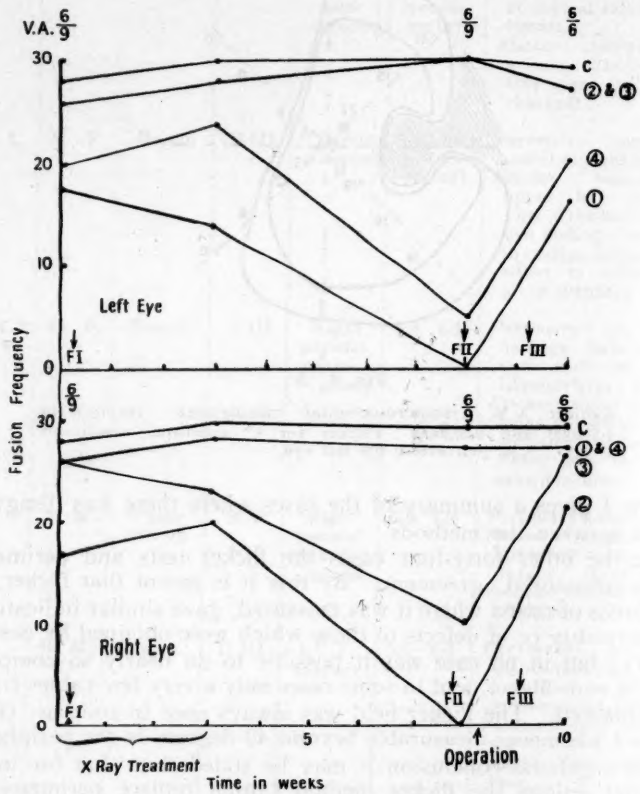

FIG. 9.

Subject P.M., pituitary adenoma with bitemporal hemianopia. Variation in values at 20° in periphery during 10 weeks. Conditions B.V. C = values at centre.
(1) Upper left quadrant (2) upper right quadrant (3) lower right quadrant (4) lower left quadrant.

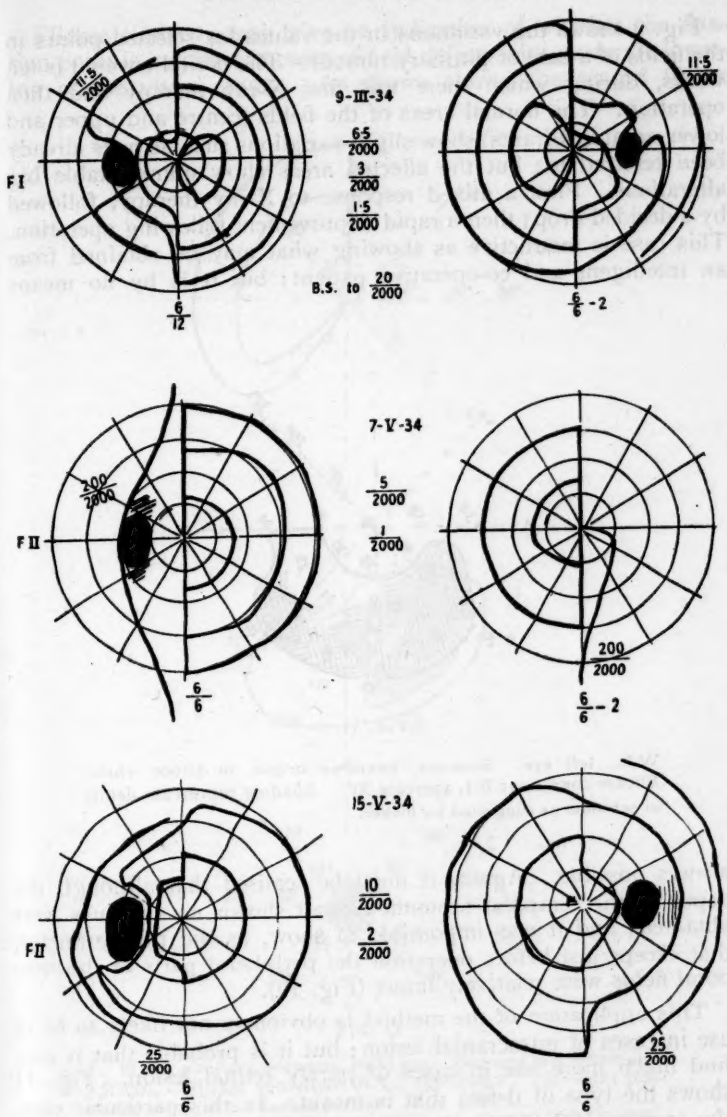

FIG. 10.

Fields of subject P.M. taken on the dates indicated at *FI*, *II* and III in Fig. 9. Sizes of white objects and distance in millimetres from black screen shown in figures.

Fig. 9 shows the variations in the values for selected points in the fields of a case of pituitary tumour. The period covered is ten weeks, during which there was first X-ray therapy and then operation. The normal areas of the fields (centre and upper and lower nasal quadrants) show slight variations such as have already been referred to; but the affected areas show unmistakable big alterations. First a mixed response to X-ray therapy, followed by a decided drop; then a rapid improvement following operation. This case is instructive as showing what may be obtained from an intelligent and co-operative patient; but it is by no means

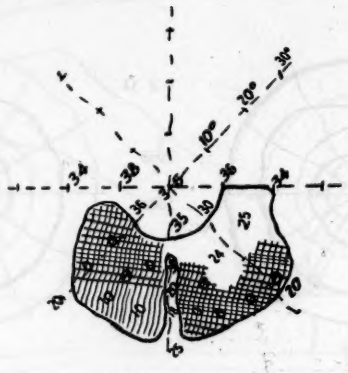

FIG. 11.

W.L., left eye. Scotoma, unknown origin, to 5/1000 white. Flicker conditions B I, aperture 30°. Shading represents depth of scotoma as suggested by flicker.

always possible. Again, it must be realised that although the depth of the temporal scotoma is well shown no contours were obtained; and it was impossible to show, as did the perimeter, that except just before operation the peripheral parts of the temporal fields were relatively intact (Fig. 10).

This application of the method is obviously not likely to be of use in cases of intracranial lesion; but it is probable that it may find much more use in cases of purely retinal lesion. Fig. 11 shows the type of defect that is meant. In this particular case, the cause of the scotoma was never discovered, but it illustrates the point fairly well; for the depth of the scotoma was not successfully shown with graded objects.

Flicker similarly may give an indication of whether the fixation point is involved in cases of field defects with moderate lowering of the visual acuity. As shown above, the central flicker

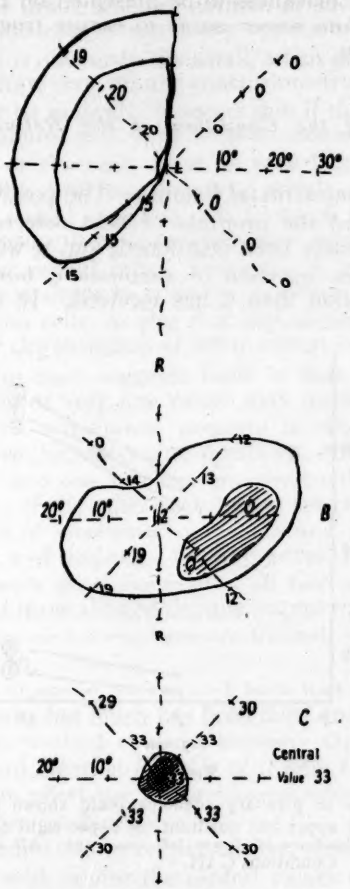

FIG. 12.

A. W.N., pituitary adenoma, right eye. Isopters to 6.5/2000 and 9.5/2000. Flicker conditions B.V., aperture 2°. L = light just visible at about 2-5 flashes per sec. V.A. 1/60.
B. L.W., left frontal meningioma, right eye. Isopter for 11.5/1000. C III, 2°. V.A. 6/36.
C. D.J., left eye. Apparent varying relative central scotomata for 9.5/2000 and 3/2000. Flicker values, nevertheless normal. V.A. 6/18. B.V., 1° 20′.

values are usually normally a little lower than those at 10 degrees; but when the fixation point is involved, there may be a marked lowering of the central value even though a 2 degrees object can be seen (Fig. 12). It is in such cases that the mirror method is useful in allowing blackness to be presented on the test patch in contrast to the white screen so as to ensure true fixation before the flicker appears.

(2) *The Effect of the Condition of the Retina upon Fusion Frequency.*

(*a*) *In cases of intracranial lesions*:—The possibility of the use of flicker to record the progress of field defects due to retinal conditions has already been mentioned, and it will be referred to again below. The question of summation, however, probably merits more attention than it has received. In cases of relative

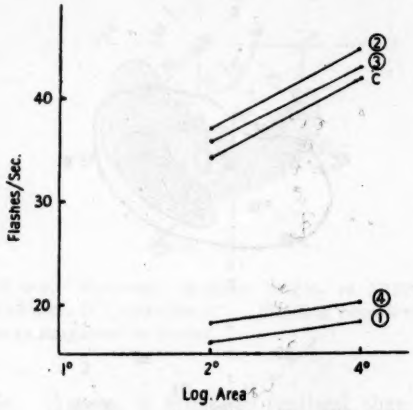

FIG. 13.

J.O.H. Case of pituitary adenoma (field shown in Fig. 8A). Left eye. (1) upper left quadrant (2) upper right quadrant, (3) lower right quadrant (4) lower left quadrant. All taken at 20° in periphery. Conditions C III.

scotoma, as has been said, the Granit-Harper law holds good, but the slope of the line is often less than in the normal parts of the field (Fig. 13). This would argue retinal damage, as distinct from nerve or tract damage; for Granit and Harper[9] have produced good evidence that summation is mediated by the intraretinal synapses.

An analysis has been made, therefore, of the forty-one cases in which summation was tested. They separated into two main groups, those with good summation and those with poor summation; and they were further subdivided according to the condition of the fundi, whether normal, or showing primary optic atrophy, papilloedema or secondary optic atrophy.

The material is obviously too small, when divided into so many categories, to draw very definite conclusions from. But the following points may be noticed. It seems that if the fundi are normal, summation is almost sure to be normal. Secondly, a lesion affecting the retina or the optic nerve is very liable to produce poor summation; but primary atrophy, which presumably would affect only the retinal ganglion cells (through their axons), is just as likely to produce it as is papilloedema, which may very likely affect also other retinal cells. From this it may be argued that either summation depends upon the presence of the full complement of ganglion cells, or else that degeneration of the ganglion cells can cause degeneration of other retinal cells as well.

Another point that suggests itself is that papilloedema with poor summation or very low values may mean a poor prognosis, even though the intracranial pressure is relieved; for of seven such cases, three died soon after operation, one had a very stormy convalescence, and one has not improved either in vision or in general health; of the other two, whose convalescence was good, one was a case of metastatic carcinoma and has since died, the other is very well indeed. On the other hand, five cases of papilloedema with good summation all had a fairly steady convalescence, and three showed definite improvement in vision; only one of them, whose tumour was not located, has failed to regain very good health.

(*b*) *In cases of ocular lesions*:—I have had no personal experience of this work; but much has been done and is still being done with the flicker method at the University Ophthalmic Clinic in Helsingfors, and mention is made of it here for the sake of completeness and to offset the rather adverse criticism of the method which this paper produces.

Teräskeli[22] found that in twenty-one out of fifty cases of monocular amblyopia with squint the central values of the diseased eye were high like the peripheral (10 degrees) values. She then further investigated fourteen of these twenty-one cases and showed that in twelve of them summation at the centre was also high, as in the periphery. She argues from this that in many cases of unilateral amblyopia with squint the fovea is lacking in the affected eye, and that the squint in these cases is due to the amblyopia, and not vice-versa.

Enroth and Werner[5] have compared the adaptation curve as obtained by the ordinary measurement of the threshold of dark-adaptation with a similar curve giving flicker readings. The results are interesting; and are being applied to the study of changes in glaucoma.

It seems undoubted that the flicker method is to have a place in ophthalmic work, whatever its deficiencies in the type of case studied in this paper. It is also probable that just as the method has been used to study such a fundamentally neurophysiological problem as inhibition[12], so it may be used in the study of changed neuronic responses in neuropathology, for instance in the Psychoneuroses.

Conclusions

(*a*) *In cases of intracranial tumour*:—(1) Campimeter fields and flicker fields in general agree.

(2) Neither is the more sensitive; flicker will show no defect that cannot also be found with careful campimetry; and moreover flicker results are much more difficult to interpret, owing to their greater dependence upon external conditions such as lighting, and upon age, etc.

(3) Flicker cannot show contours as in campimetry.

(4) Flicker may, however, be used to estimate the density of scotomata with fair accuracy. It may also serve to indicate if the fixation point is especially involved in cases that show a lowered visual acuity.

(5) The flicker method is at least as difficult as campimetry, and the technique is just as difficult to learn. One set of conditions should be decided upon and adhered to, as otherwise calibratory control cases, which are essential, become invalid.

(6) The apparatus recommended is a compact one (C III of the Appendix). If it is hoped to *detect* field defects, the flicker should be of the same intensity as the screen; but if *known* scotomata are to be measured, a brighter light may be easier to use.

(*b*) *In other conditions*:—The method will probably find greater application in purely ocular conditions, as suggested by the work of Granit, and as successfully used already by Teräskeli and by Enroth and Werner.

It may also prove of use in some purely neurological conditions.

I am indebted to so many people, that it is impossible to mention all. Chiefly, to Mr. Cairns for his interest and the permission to use his cases for the work; to the students and the assistants in the clinic who so willingly acted as controls; to Mr. Phillips, who showed me the method, to Dr. Granit for much further help and

advice; and lastly to members of the Hospital Surveyor's Department who were responsible for most of the apparatus.

The work was done under a grant from the Charles Bingham Bolton Fund for Neurology.

Appendix

DESCRIPTION OF THE APPARATUS AND ITS MODIFICATIONS.

A I. Phillips's arrangement ([17]) is shown in Fig. 2A. Dark background reflecting no light; brightness of flicker about 7·5 equiv. f.c. at 1 metre (position of patient); apertures of 1·5 degrees and 2·5 degrees.

A II. Black cloth screen instead of X-shaped frame for the fixation discs. White diffusing screen behind patient, so that black screen was lit fairly uniformly by diffused light. This gave the white fixation discs brightness of 3 equiv. f.c. as seen by patient. Apertures of 12 min. to 3 degrees used.

B I. White screen (of about 1·5 sq. metres at 1 metre distance) used so as to allow some degree of light adaptation and thus increase flicker perception ([4]). White shutter and diaphragm. Test patch in view all the time (as before), with brightness of 1 equiv. f.c. when not lit by flicker light. Average brightness of white screen 2·5 equiv. f.c.

B II. Test patch placed behind fan so that it was completely occluded in each dark phase. Flicker generally brighter than ground (7·5 equiv. f.c. compared with 2·5 equiv. f.c.). "Falling" method first tried.

B III. Fan placed just in front of light again so as to give rapid cut off; but test patch moved back till unlit by general lighting. Flicker thus reduced to 7 equiv. f.c., but with more definite dark phases.

B IV. Distance of white surrounding screen 1·5 metres, so as to allow more even illumination. Its brightness was now about 1 equiv. f.c. Apertures of 20 ft. to 2 degrees. Shutter removed.

B V. Flicker reduced in brightness till equal to screen (1 equiv. f.c.)

C I. Mirror method. Brightness of screen reduced to 0·5 equiv. f.c. to match flicker, which was reduced of course by the interposition of the mirror.

C II. Stronger lamp. Flicker and screen now 1 equiv. f.c. again.

C III. Small white screen of 30 square degrees at 0·5 metre. Apertures of 2 degrees and 4 degrees actually cut in interchangeable screens, so as to avoid the break in the reflecting surface caused at the junction of screen and diaphragm. Screen and flicker equal at about 1 equiv. f.c.

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A RETRO-TRANSILLUMINATOR

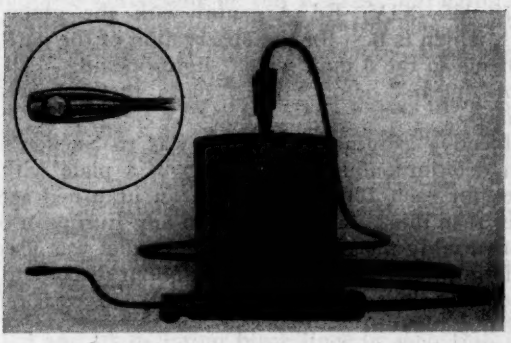
BY

J. GRAY CLEGG

MANCHESTER

CASES occur not infrequently in the practice of a busy ophthalmologist where a dark mass is discerned in the fundus. The question then arises, is it, or is it not, malignant? Such a mass may be opaque to the passage of light. If the suspected growth is in the anterior third of the globe, transillumination through the conjunctiva and sclera in the ordinary way is a most satisfactory proceeding. If, however, the mass is more posterior, grave doubt may arise. Some time ago Lancaster, of Boston, U.S.A., suggested transillumination by means of a lamp passed, after a cut in the conjunctiva and Tenon's capsule, towards the back of the globe. This method was mentioned by Rönne, of Copenhagen, in a lecture given to the North of England Ophthalmological Society. I decided to have a special lamp constructed, which was carried in a narrow

metal tube curved with a radius of 13 mm. to correspond roughly with the normal curve of the sclera. The lamp itself is of a 3-volt. power, and is inserted into a slightly bulbous end of the tube, and sealed in position opposite a 2 mm. diameter aperture. To give a rough idea of the distance of the shadow from the corneal limbus the curved tube is marked at 25 mm. from the lamp and then at every 5 mm. The light given is quite sufficient to supply a good transillumination, and the exposed part of the lamp can be passed quite easily in any desired direction in order to have it exactly posterior to a mass in practically any position in the globe. The portion of the metal tube to be



brought in contact with the tissue can be readily sterilised in rectified spirit. It is not advisable to boil the tube. One or more spare tubes should be at hand, as, if the lamp gives out, it is not in practice worth replacing in the same tube. The heat given off is not great enough to cause damage to the tissues. Further, although there is a possibility of damage to the venae vorticosae, the posterior ciliary nerves and vessels, the instrument need only be used in serious cases, and in practice the risk of doing much damage is not great. The trauma produced by introduction is negligible. Practice has shown that it is not necessary to interfere with the extrinsic muscles, and that it is advisable for the surgeon viewing the interior of the eye to have the lamp-holder in his own hand, and if necessary move it about. When observing the light through the pupil no mirror is required; it is observed by the naked eye of the surgeon.

This method may be of considerable use in the localisation of holes in cases of detached retina.

The instrument has been made on my direction, and can be obtained from Messrs. Theodore Hamblin.

KINESCOPY—OBJECTIVE AND SUBJECTIVE (SUPPLEMENTARY REMARKS)*

BY

S. HOLTH, M.D.

OSLO

I AM obliged to supplement my lecture on May 31, 1935, at the annual meeting of Norwegian oculists, printed in the November number of this journal 1935, pp. 603-609, with a few words.

The electrical lamp seen 1. c. in Fig. 4 is the Dutch " Philips " (240 V. 75 W—XIV, Ed Argenta) with the globe of white *milk glass,* which is best for the observation of the dark band and its movements in the 5 mm. wide " light-opening "; if the globe is made of " clear " or of " dull " glass, these observations will be less sharp.

For subjective astigmometry there was in Snellen's Optotypi ad Visum determinandum (Utrecht 1892) a plate with radiating black lines for each 10th meridian in an upturned semicircle; I have never seen this " fan " applied in any European ophthalmic clinic. Invariably the circle-formed clock dial was used with the black radiating lines placed both at each hour (each 30th meridian) and at each half-hour (each 15th meridian)—to great relief for the subjective observation.

In my Kin. S-disc (1. c. Fig. 2 and Fig. 3) I have placed *white*† marks on the black background in each 5th meridian, which make good service in subjective astigmatism of $\frac{+}{1^{\circ}}$ 1·0 D. or more; here the meridian determination is sharp up to 1° or 2°,

FIG. 1.

The 22 cm. long and 2 mm. thick steel knitting needle from 1904, showing the dark band and its movements in the " light opening " by subjective Kinescopy in ametropia of 0·12 D. or more.

the oculist setting the narrow white rule of the Kin. S-disc. in exact prolongation of the right line.

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* Lecture and demonstration, December 12, 1935, at the monthly meeting of Oslo oculists.

† The deepened marks and numbers are filled with " white ink "—a cretaceous emulsion. Corrected ametropes with normal visual acuity do not understand the white numbers in the distance of 6 metres.

In refraction anomalies of + 0·5 D. and more also, this 2·0 mm. thick transparent *glass rod* (Fig. 2.) gives the dark band and its movements in the " light-opening "—a new demonstration of the fact that this band is not a " shadow."

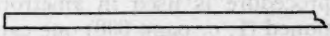

FIG. 2.

A 2·0 mm. thick completely transparent and colourless glass rod, showing the dark band and its movements in ametropies of 0·5 D. and more by subjective Kinescopy.

After complete correction of the weakest refracting principal meridian of an astigmatic eye with a *spherical* lens, this eye sees—by subjective astigmatism of + 1·0 D. or more—a sufficiently long sharp " light-line," indicating the direction of the strongest refracting principal meridian; the oculist moves the 5 mm. broad white indicator of the Kin. S-disc (l. c. Fig. 2 and Fig. 3) in the projection of this " light-line," which by sharp observers may go to 1° or 2° beside each 5th meridian—*e.g.*, 13° or 17° near 15°. These 1° or 2° deviations may be delineated and written in the spectacle prescription.

In subjective astigmatism under + 1·0 D. this " light-line " is too short for a certain indication of the direction of the strongest refracting meridian; here the oculist is obliged to be content with the clock dial and its radiating black lines in each 15th meridian.

Naturally one does always begin with the objective methods. The " Skiascopy " of Cuignet (1873) is excellently worked out—but requires great experience.

The Ophthalmometer of Javal and Schiötz (1881) is easy, swift and is always to be used, because by doing so the subjective examination will be less difficult; but with the ophthalmometer the anterior corneal astigmatism only is measured. In the total astigmatism the direction of the principal meridians may deviate 5° to 20° from the corneal one.

The most important in the correction of the subjective total astigmatism is the exact determination of the axis direction of the two principal meridians. At first the direction of the strong refracting principal meridian is determined by the light-line from the spherically corrected weak refracting principal meridian; the direction of the last one is 90° further away. Then the Kin. S-lamp is extinguished and an approximately fitting concave cylinder is set in the trial-frame with the axis in the weak principal meridian. By alternative additions of + cylinders one tries to obtain the best visual acuity. Now the Kin. S-lamp is lighted

again and with movements of the knitting needle vertically to the strong refracting meridian one tries to obtain movements of a possible dark in the " light-opening " with or against that of the knitting needle: altering of the concave cylinder only, when thereby an improvement of the visual acuity is obtained.

An analogous procedure is used in ametropia without astigmatism. As mentioned (1. c. page 608) one can here in full daylight rapidly decide if the ametrope with vertical movements of the knitting needle before the eye observes a dark band in the " light-opening " going with the needle (myopia) or against the needle (hypermetropia). Now the Kin. S-lamp is extinguished and one seeks the spherical lens giving the best visual acuity; the Kin. S-lamp is lighted again and with vertical movements of the knitting needle before this lens one seeks possible movements of a dark band in the " light-opening " with or against that of the needle: altering of the spherical lens only when thereby the visual acuity is improved.

In this manner one saves time under exact subjective refractometries in all ametropies.

One ought not—as proposed in the text to Fig. 2 and Fig 3 (1. c. page 606)—buy the isolated Kin. S-disc. It is much better to buy the complete lamp-stand seen in Fig. 4 (1. c. page 607); with this apparatus follows the knitting needle 2 mm.; illustrated here in Fig. 1.

But instead of the (in 1. c. Fig 4) illustrated stiff rule one gets from M. Gallus, Pilestredet 8, Oslo, a thin steel band, rolled up in a nickel capsule, the band one-and-half-metres long and divided in centimetres on one side and in English inches on the other side. The total price is then Kr. 64·50 plus freight expenses.

With this steel band the height over the floor of sitting ametropes (children and adults) is quickly measured—and immediately afterwards the same height is given to the " light-opening " of the Kin. S-disc.

THE FIRST RADIUS-FIGURE FOR SUBJECTIVE ASTIGMOMETRY*

BY

S. HOLTH, M.D.

OSLO

JAVAL demonstrated on September 4, 1865, at the Heidelberg meeting (*Klin. Monatsbl. f. Augenheilk.*, 1865, pp. 336-340) an apparatus containing seven concave cylindrical lenses, which by combination represented 19 different concave cylinders with the axis adjustable in any meridian. The apparatus was not only for use in astigmatism in myopia (Javal's own refraction); by means of convex spherical lenses in the trial frame this apparatus could be used for astigmatism in any eye. The fact was, that the examination was made in near distance and *binocularly* with two objects; a circle before one eye and radiating lines before the other eye; the intention of this measure was to suspend convergence and accommodation—and in this way atropine should be superfluous.

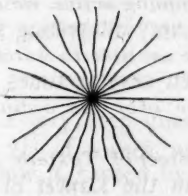

FIG. 1.

Javal's radius figure in each 15th meridian for astigmometry at near distance.

The quoted report was not illustrated; but Javal's little radius figure for each 15th meridian may be seen in the first German edition of F. C. Donders "Die Anomalien der Refraction und Accommodation des Auges" (Wien 1866), p. 383, Fig. 153, which is reproduced here, Fig. 1, in the original size.

It is this radius-figure, magnified for the distance of six metres and surrounded with the clock periphery (radiating lines for every hour and for every half-hour), which even to-day is used by nearly all oculists for subjective astigmometry.

* From a lecture and demonstration, February 6, 1936, at the meeting of the Oslo Oculist Union.

COD LIVER OIL AS LOCAL TREATMENT FOR EXTERNAL AFFECTIONS OF THE EYES

BY

EDGAR STEVENSON

LIVERPOOL

FOR the past six months I have been experimenting with cod liver oil as a local treatment for various eye conditions, and have been able to arrive at certain conclusions, the chief of which is that the oil has an undoubted and rather surprising efficacy as a healing agent. It is obvious that in trying out any new method of treatment the more one can exercise direct supervision of all the cases treated, the better one can assess the results, and it happens that we are favourably placed as regards this supervision, as my partner and I have arranged part of our premises as a private out-patient department, to which are sent eye accidents from the local shipyards and from other works further afield. All of these cases need more skilled attention than can be given by the firm's ambulance departments. We have two skilled assistants and now that shipbuilding is once more becoming active, we deal with a large number of cases. (I started this very interesting sideline over thirty years ago.) In consequence we are able to watch the progress of a case from day to day, or even several times daily if necessary, thus having a great advantage over the ordinary hospital out-patient department.

I am indebted to Dr. Steel of Toxteth Infirmary, Liverpool, for his interesting account in the *Lancet* of August 10 last, of his treatment of burns with cod liver oil, and was much impressed by the apparent absence of scarring in his cases. I was actually reading his Paper on August 13, when a case most aptly arrived—a very severe burn of the inner half of both right lids from a red hot rivet, which adhered to the patient's lids till he had reached ground from the top of the 40 ft. ladder on which he was working.

I put in a drop of weak atropine solution, dressed the burn with a thick pad of gamgee soaked in ordinary cod liver oil covered with oiled silk and a bandage, and sent him home and hoped for the best. Next day it seemed to be doing well, no pain, a good deal of mucoid discharge. This was gently wiped off and an oiled pad reapplied. The patient was instructed to get a small bottle of the oil and to keep the pad moist by pouring some oil on the outside of the pad if it seemed to get dry. He was seen daily for a week, by which time the lids were filling up. After that he was allowed to use the oil at home and attend every three days. In exactly four

weeks the lids were filled up and healed. Both canaliculi had escaped destruction; there was no scarring; skin quite soft, but rather red and itching. He had no treatment except the oil and wiping away any mucus and the preliminary drop of atropine. He returned to work on September 15, and two months later turned up with a localised deep burn of the left eyeball, just clear of the cornea at the inner side. This healed in five days with the oil, leaving a small and rapidly diminishing white patch of scar tissue in the conjunctiva. The right eye looked normal except that the lids had lost their sharp cut edges where burnt, and also, some lashes; no sign of scarring or lacrymation.

This case is typical as regards treatment, and was the most severe of other similar accidents.

One interesting case on December 2, had a splash of liquid caustic (used in cleaning hulls of ships) dropped into his right eye from a height of 30 feet, damaging the conjunctiva of the upper lid, lower half of cornea and conjunctiva, and deeply burning the lower fornix. Very painful, much chemosis and swelling of lids. Oil was used freely and atropine for two days. The eye improved rapidly, but a symblepharon was forming in the lower lid. This was quite soft, very easily separated and did not recur. On December 7, five days after the accident, upper lid, cornea and conjunctiva were normal except for much redness in the lower fornix. Eye comfortable. Returned to work.

Other corneal conditions.

(1) On February 17, a very deep linear abrasion, about 1 mm. wide, horizontally across 2/3 of cornea, with ragged edges, and a smaller one less deep below it, caused by flying piece off head of rivet. Some particles of dirt were removed from the edges of the wound, drops of weak atropine and oil instilled and pad strapped on. Next day pad removed. Except for an almost invisible white line in cornea, no sign of any injury. The rapid healing of this case surprised us; it really was a very nasty wound.

(2) An old lady, aged 78 years, with dendritic ulcer of left eye. Much pain and photophobia. History of previous attacks, treated by carbolising, and lasting about two weeks. One instillation of oil relieved the pain in ten minutes and stopped the lacrymation. Seen again a week later when except for two small rough spots the ulceration had disappeared and the inflammation and redness had entirely subsided. She had no other treatment.

(3) A child, aged five years, seen at Heswall Children's Hospital in October. Under treatment two years for coeliac disease and for about nine months for relapsing keratitis and ulcers of the left eye. Lids much swollen. Under treatment with slight temporary improvement and long periods of relapse. Oil tried as last resort

three times daily. The ward sister reported the result as "miraculous." Child much improved in twenty-four hours and practically well in four days, but treatment continued for some weeks to clear up nebulae with apparent success. The cornea is now bright and clear except for a very small central nebula. No relapse in four months, but is still having a drop of oil daily.

Hypopyon ulcers show rather curious results. A thick growth of epithelium forms at once (in twenty-four hours) after first instillation, turning the ulcer into an abscess. We find it better not to use the oil till active septic process has subsided. They then seem to heal very satisfactorily with minimum opacity.

I mention these few cases to show that the treatment can be used in a diversity of affections of the eyes. But we have notes of over 150 cases treated at our own clinic and we think that its use has greatly reduced the usual pre-oil number of necessary attendances. I am experimenting at present with the chronic degeneration from mustard gas, and some other chronic conditions, with so far encouraging results, and I want to try it for phlyctenular disease, but have not seen a case of this since I started the treatment.

My partner, Bernard Chavasse, has been using the treatment at the Eye and Ear Infirmary, and reports good results, but he has difficulty in following up the cases. He is specially pleased with the rapid healing of blepharitis and of general soreness of the lids.

To sum up. Cod liver oil applied locally, seems to promote growth of the natural tissues and to inhibit growth of scar tissue, in any case where there is loss of substance. It should be withheld in the ***early*** stages of hypopyon ulcer. It is harmless, can be used in conjunction with other necessary treatment, is cheap and easily applied.

The best drop bottle is one made by Messrs. S. T. Pearson and Co., Ltd., Mitcham. It has a vulcanite cap below the rubber which prevents the oil from getting on to the rubber.

The only disadvantage is the smell which, in the small quantities used for the eye, is of no consequence.

TATTOOING OF CORNEAL OPACITY WITH GOLD AND PLATINUM CHLORIDE

BY

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AND

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WHEN a corneal opacity is tattooed, two things are to be borne in mind. The first one is to get a good cosmetic effect and the second one is to obtain a permanent staining of the entire corneal opacity.

A good cosmetic appearance is produced by gold and platinum chloride methods, either of which gives a better appearance, than what is obtained by the old method of tattooing with Indian ink. Since the colour of the iris of Indians is usually dark or light brown, either of the two methods serves the purpose of hiding the white opacity with the stain and matching the colour so obtained with that of the iris.

It is difficult to obtain a permanent staining of the entire area of the leucoma, though soon after the operation it may seem it will be so. Holth[1] while referring to the tattooing with the platinum chloride solution expresses his opinion that the resulting black colour obtained by this process is more likely to give a permanent black colour than by the gold chloride method. However in the cases which have been tattooed with either gold or platinum chloride and have remained under observation, it has been noticed that the colour has a tendency to fade in a couple of months. But this changed colour has been noticed to remain the same in one case even after five years.

Another drawback is that the stained area rarely remains permanently of the same size. After a few days to a couple of months, it has been observed that the stained area becomes smaller than before on account of the stain having been partly or wholly expelled in places and thus a mottled appearance is produced. In spite of this appearance, the tattooing conceals the leucoma so well that the final cosmetic effect is not at all bad.

Twenty-nine corneal opacities were tattooed with gold chloride and fourteen with platinum chloride. All the operations were performed at Sir C. J. Ophthalmic Hospital except a few which were done in private practice. Out of the twenty-nine cases only five were tattooed with gold chloride and hydrazin hydrate and the

rest with gold chloride and tannin. All were cases of leucoma with or without adhesion of the iris in the corneal scar. In one case the corneal opacity was produced by the keratitis resulting from a lime burn. In cases where an optical iridectomy was indicated it was usually performed either ten days before or after the tattooing operation. All the cases were operated upon with a view to produce a good cosmetic effect except in one case of aniridia with a central leucoma. In this case an attempt was made to do away with the photophobia by staining a large area of clear cornea besides the central opacity. It was not successful and even the leucoma showed poor staining.

The Operation of Tattooing with Gold Chloride.
Instruments and Solutions required

Speculum, Graefe cataract knife, fixation forceps, cotton applicator, small glass containing a small quantity of gold chloride solution, small pieces of sterile blotting paper, small glass measure containing 1 per cent. tannin solution, if a brown staining be desired or 2 per cent. hydrazin hydrate, if a black colour be required, medicine dropper and normal saline in an undine for washing the eye after using tannin or sterile tap water in case hydrazin hydrate is used.

Technique.—After anaesthetising the eye with 4 per cent. cocaine solution, the speculum is inserted, the eyeball is fixed with fixation forceps at a convenient spot at the limbus and the surface epithelium covering the leucoma and a little beyond it, is scraped off with the knife. The fixation of the eye is given up, the cotton applicator is dipped into the 5 per cent. gold chloride solution and the excess of the fluid is removed by pressing the applicator against the wall of the glass. The eye is fixed again and the applicator is firmly pressed upon the denuded surface for one minute. With a steady patient the fixation of the eyeball can be done away with, three or four such applications each lasting one minute are made. The surface of the eye is continuously kept dry by an assistant with the sterile pieces of blotting paper to prevent irritation of the eye. The tannin or hydrazin solution is dropped on the denuded surface drop by drop for about twenty or thirty seconds until the denuded area becomes stained. Now the eye is washed either with saline or tap water according as the tannin or hydrazin solution has been used. After instilling atropine, vaseline is applied to the eye. Both eyes are bandaged.

Atropine is instilled daily for a week and the dressings changed daily. The unoperated eye is left open on the third day and the operated eye on the ninth day.

Complications.—None were met with after the operation. Even in cases of adherent leucoma, iritis did not occur. Slight keratitis which resulted from the application of gold chloride always cleared up in a few days.

Comments.—The strength of the gold chloride solution was varied from 2 to 5 per cent. and it was found that 4 or 5 per cent. solutions uniformly gave the best results. A freshly prepared solution was preferable to a stock one which however was serviceable for 6 weeks after which period it was discarded as suggested by Soudakoff[2]. Its strongly acid reaction was made faintly acid to litmus paper with 5 or 10 per cent. sodium bicarbonate solution, to prevent irritation of the operated eye.

Two per cent. hydrazin hydrate solution was always freshly prepared in a small quantity say about 2 drachms. 1 per cent. tannin solution was also freshly prepared before use. Its instillation was more painful than that of hydrazin hydrate which was also preferable to tannin on account of the resulting black colour.

In one case the application of gold chloride was also followed by instillation of adrenalin solution but the staining was very poor. As a reducing agent uviol light was not found so satisfactory as tannin or hydrazin hydrate, though Gifford and Steinberg[3] obtained good results with it in one case.

The cotton applicator was made by firmly wrapping cotton wool round a wooden stick or a glass rod, and the end of the swab was cut across and trimmed so as to correspond as nearly as possible to the size of the leucoma. It was sterilized with other dressings. In case the surface was found to be too large to be covered by even a large applicator, the area was divided into two segments and each one was treated separately.

A knife and never a trephine was used to prepare the leucoma for impregnation with gold chloride. It was found necessary to scrape the surface right up to the edge of the leucoma to prevent the appearance of a white line around the stained area. The superficial epithelium was always thoroughly removed and it was usually found unnecessary to scarify the leucoma deeply.

A slight keratitis was produced by the gold chloride which came in contact with the cornea surrounding the opacity. However, it cleared in a week or two. The spot at which the eye was fixed with fixation forceps was usually found to be stained slightly. This colour always disappeared in about four weeks. The conjunctiva of the eyeball specially in the lower half got stained, dark grey in colour, which however disappeared in a few days. In a few cases of vascular leucoma it was noticed that the pigment disappeared from a large portion of the tattooed area in a short time. To overcome this difficulty, in one case the blood vessels were divided

at the limbus as advised by Bartels before thoroughly scraping the surface of the vascular leucoma, but the result was not satisfactory. Some of these cases required to be tattooed a second time.

Those cases, in which the tattooing was not successful at the first attempt, were operated upon a second time after a week; and it was noticed that the second operation which produced a good cosmetic improvement was well borne by the eye in such a short time.

Case Reports

A few cases are reported below with a view to give an idea of the result of the operation of tattooing with gold chloride.

CASE NO. 1.—A Hindu male, aged 25 years, had leucoma of both eyes. Vision of the right eye was 6/36 and that of the left eye fingers at one foot. As desired by the patient only the left eye was operated upon at Sir C. J. Ophthalmic Hospital on August 30, 1929. After scraping the surface of the moderately large leucoma, 5 per cent. solution of gold chloride was applied for 5 minutes and 1 per cent. tannin solution was instilled. The colour changed to dark brown giving a good cosmetic result. He was discharged on September 5, 1929, as he wanted to go to his village.

CASE NO. 2.—A Hindu male, aged 30 years, had the adherent leucoma of his left eye tattooed at Sir C. J. Ophthalmic Hospital on the 22nd October, 1929. The opacity was large and vascular. The right eye was normal. 5 per cent. solution of gold chloride was applied for 4 minutes followed by 1 per cent. tannin. The cosmetic effect was good. Optical iridectomy was done on October 29, 1929, with improvement of vision from a few feet to 6/36. There was very little irritation after either operation. He was discharged on November 3, 1929. When seen 2 years after the operation the pigment had partly faded and disappeared.

CASE NO. 3.—A Mahomedan, aged 22 years, had a fairly large leucoma of the right eye. The left eye was normal. An optical iridectomy which was performed on September 10, 1929, at Sir C. J. Ophthalmic Hospital improved his vision from 6/60 to 6/24. On the 17th September, the leucoma was tattooed by applying 5 per cent. gold chloride solution for 4 minutes and instilling 1 per cent tannin solution. Recovery was uneventful and cosmetic improvement good. He was discharged on September 21, 1929. In this case optical iridectomy was done before tattooing.

CASE NO. 4.—A central medium sized vascular leucoma of the right eye of a Hindu male, aged 26 years, was tattooed on

August 2, 1935, at Sir C. J. Ophthalmic Hospital with 5 per cent. gold chloride solution which was applied for 4 minutes and followed by instillation of 2 per cent. hydrazin hydrate solution. It did not take up the stain well and the few black spots of pigment which were there after the operation disappeared in about 4 days. Hence the process was repeated on August 13, 1935, with good cosmetic result. As there was slight keratitis and some irritation of the eye, he was kept under observation till September 2, 1935, when he left the hospital with a quiet eye showing a black colour.

The Operation of Tattooing with Platinum Chloride, Instruments and Solutions required

Speculum, fixation forceps, Graefe cataract knife, cotton applicator, sterile pieces of blotting paper, a small glass vessel to hold a small quantity of 2 per cent. platinum chloride solution, a small measure glass containing 2 per cent. solution of hydrazin hydrate, medicine dropper, and sterile tap water in an undine. Both the solutions are freshly prepared before use.

Technique.—The eye is cocainised with 4 per cent. solution of cocaine and the speculum applied. The eyeball is fixed with the fixation forceps at a convenient spot near the limbus whenever required during the operation. The leucoma is scraped with the knife. The solution of platinum chloride is applied with the applicator by firmly pressing it against the denuded surface for one minute. A second similar application is done for another minute. 2 per cent. hydrazin hydrate solution is dropped on the surface of the leucoma for about 25 seconds, during which period the leucoma is seen to turn black. Throughout the operation the excess of solution is removed by an assistant with the sterile pieces of blotting paper. Finally the eye is washed with the sterile tap water, atropine is instilled and vaseline applied before bandaging both the eyes.

Complications.—None were noticed in the cases operated upon except slight keratitis which disappeared in a few days.

Comments.—The 2 per cent. strength of platinum chloride was always found to be suitable for tattooing. Stock solution of platinum and hydrazin hydrate were useless for staining so both of them were always prepared shortly before operation. The time for the application of platinum chloride was always two minutes, but in those cases in which the operation had failed it was increased to three or even four minutes without any harm.

The final colour of the tattooed area was found to change from black to dark grey after about a month. In one case which was

tattooed five years ago the dark grey colour was found to be the same even after that period. The black colour obtained by tattooing with platinum chloride and hydrazin hydrate was slightly darker in tint than with gold chloride and hydrazin hydrate.

The behaviour of the vascular leucoma with the platinum chloride tattooing was the same as with the gold chloride method. In some cases, the white line surrounding the blackened leucoma, on close inspection looked more prominent with the platinum chloride tattooing than with the gold chloride and tannin because of the contrast in colours.

Case Reports

There was nothing unusual about the fourteen cases tattooed with platinum chloride with the exception of two which are briefly described below.

CASE No. 1.—A Mahomedan, aged 32 years, wanted to have the adherent leucoma of his left eye tattooed. An optical iridectomy had previously been done and the vision of that eye was 6/18, while that of the right eye was 6/6. The leucoma which was fairly large was tattooed at the Sir C. J. Ophthalmic Hospital on November 15, 1929, with platinum chloride, but it showed no staining of its white surface after completion of the operation. The tattooing with 2 per cent. platinum chloride and hydrazin hydrate solution which was repeated the next day, resulted in black staining of the entire leucoma. No complications occurred, and the eye quieted down. A thin white line surrounded the blackened area all round and looked rather unsightly on close inspection. He was discharged on November 25, 1929. On December 28, 1929, he was again examined as an out-patient, when the black colour was noticed to have slightly faded. When he was seen again on February 3, 1930, the colour had not faded further but the stain had been expelled from a small portion of the leucoma on the inner side. The white line was still there.

CASE No. 2.—A Parsi male, aged 23 years, wanted to have the corneal opacity of his left eye tattooed. It was a fairly large opacity which had resulted from a lime burn of the conjunctiva. An iridectomy was first performed on August 15, 1930. The vision of the left eye had improved to 6/60 from finger counting at about 3 feet, while that of the right eye was already 6/6. After a month the tattooing of the left eye with 5 per cent. gold chloride and 1 per cent. tannin solution was done. The time of application was 4 minutes. It stained the opacity poorly and in a fortnight very few particles of pigment could be seen. The eye which was slightly irritable quieted down in about 15 days.

Another tattooing with application of 2 per cent. platinum chloride for 2 minutes and instillation of 2 per cent. hydrazin hydrate was done on October 3, 1930. The opacity was fairly well stained and was jet black in colour. However in about a month the colour faded a little and the stain had partly come away producing a mottled appearance which is the same even now after five years, and the cosmetic effect also fairly good.

Summary

1. Twenty-five cases were tattooed with gold chloride and tannin and four with gold chloride and hydrazin hydrate with fairly good cosmetic result. The use of tannin which produced a brown tint was more painful than hydrazin hydrate which gave a black colour.

2. A slightly acid 4 or 5 per cent. solution of gold chloride was applied to the denuded surface of the leucoma for 4 or 5 minutes. The strength of tannin was 1 per cent. while that of hydrazin hydrate 2 per cent.

3. In vascular leucoma the colour obtained by tattooing with either method slightly faded and partly disappeared in some cases which required a second operation.

4. Fourteen cases were tattooed with freshly prepared 2 per cent. solution of platinum chloride and 2 per cent. solution of hydrazin hydrate. The colour obtained by this method was jet black.

5. Iridectomy could be done either before or after tattooing with either method.

6. Out of the cases reported in this article two are of special interest. One which was tattooed with gold chloride and tannin showed a fairly good cosmetic effect even after two years, while in the other case tattooed with platinum chloride and hydrazin hydrate, the slightly faded black colour had remained unchanged for five years.

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2. **Sondakoff.**—Further observation on tattooing the cornea with gold chloride method (Knapp's method). *Nat. Med. Jl.*, China, Vol. XVII, p. 75, February, 1931.

3. **Gifford, Sanford R. and Steinberg, A.**—Gold and silver impregnation of cornea for cosmetic purposes. *Amer. Jl. of Ophthal.*, p. 241, April, *1927*.

ANNOTATION

Ophthalmic Research in Glasgow

We noted last year, p. 429, the appointment of Dr. A. J. Ballantyne to the Professorship of Ophthalmology in connexion with the endowment of the trustees by the late Dr. Gavin Tennent.

We are indebted to Dr. W. C. Souter for sending us a reprint from the *Glasgow Herald* of April 10, 1936.

The ophthalmological department endowed by Dr. Gavin Tennent's will was formally opened at the Western Infirmary, Glasgow, on April 9. Sir John Roxburgh, LL.D., Chairman of the Board of Managers, presided, and gave a brief outline of Dr. Tennent's career. By his will Dr. Tennent directed his trustees to pay to the University of Glasgow a sum sufficient to found a Chair of Ophthalmology, and he also allocated a sum to the Western Infirmary to provide a suitable building in connexion with the infirmary.

The building has been erected at a cost of £45,000, the architect being Mr. Norman A. Dick, who had the collaboration of Col. Mackintosh, the medical superintendent of the infirmary. Dr. Maitland Ramsay was unable to be present on account of illness, and his speech was read by Col. Mackintosh.

Professor T. K. Monro, Professor of the Practice of Medicine at Glasgow University addressed the company and the door was opened by a gold key. Professor A. J. Ballantyne, the director of the new department, proposed a vote of thanks to the various speakers. These speeches are reported in the *Glasgow Medical Journal*, May, 1936, together with a portrait of Dr. Tennent and views of the new building.

It is peculiarly appropriate that this magnificent foundation by a medical man, who passed his professional career in Glasgow, should be erected in the city of the great William Mackenzie, the father of modern clinical ophthalmology. Surely his shade was hovering over the building on its opening day. And we are convinced that, under the present Director and his successors, the Tennent foundation in ophthalmological research will go on from strength to strength. Endowments for any branch of medical research have been all too rare in this country, apart from the Radcliffe and Addenbrooke bequests and some others, notably that of Lord Iveagh.

Glasgow is to be congratulated on the fact that one of her sons has seen fit to make this provision for the future. And the ophthalmological fraternity should be grateful to the memory of the Glasgow physician who appreciated the value to posterity of an ophthalmological research centre and took such practical steps to further it.

ABSTRACTS

I.—CORNEA

(1) **Kuo Ping Kuan (Vienna). — White rings on the cornea. (Ueber weisse Ringe in der Hornhaut).** *Arch. f. Ophthal.*, Vol. CXXXV, p. 135.

(1) **Kuo Ping Kuan** here adds to the list of cases of white rings in the cornea already recorded (vide *Brit. Jl. Ophthal.*, Vol. XVII and XVIII) a description of eleven observed by himself.

In offering a theory of the aetiology of this condition, which is always situated in Bowman's membrane, he remarks that it seems natural to suppose that it arises from some change in the pores in that membrane or the nerves passing through them from the plexus under it; disease of a portion of this nerve plexus might cause a breaking-down of the most superficial layers of the stroma and the adjacent parts of Bowman's membrane. But as this would not account for the arrangement of the white spots in rings he suggests that Bowman's membrane may be invaded by some process from the pores in the form of toxins passing through the pores and producing cloudy swelling or necrosis in the membrane, which may lead to precipitation of albumin, fatty degeneration or deposit of mineral salts at the margin.

He concludes that the formation of these white rings is due to disease of a perforating nerve, but leaves it open as to whether the cause is the direct action of toxins on the membrane with subsequent necrosis or a trophic disturbance.

He thinks that this change very possibly takes place in foetal life, *i.e.*, he regards the white rings as congenital; an exogenous cause scarcely requires consideration.

THOS. SNOWBALL.

(2) **Saul, H. (Kiel). — The fate of patients with interstitial keratitis. (Ueber der Schicksal der Patienten mit Keratitis parenchymatosa).** *Zeitschr. f. Augenheilk.*, Vol. LXXXVI, p. 199, 1935.

(2) **Saul** followed up 100 cases of interstitial keratitis seen between 1905 and 1920. He found

(1) Vision of less than 1/6 in 16 cases, 11 of whom were practically blind.
(2) Myopic astigmatism in 53 eyes.
(3) Vertical elongation of the cornea in 13 eyes.
(4) Pupil disturbances (absolute or reflex rigidity) in 15 cases, who were otherwise free from neurological lesions.
(5) Deafness of varying degree in 35 cases.
(6) Hutchinsonian teeth in 31.

As far as the course of the affection was concerned, the time of onset did not seem to be a matter of significance, nor could any difference be established as between the cases treated with N.A.B. or mercury. An excessive incidence of sterility is also probable.

ARNOLD SORSBY.

(3) **Colomba (Padua). — Choroiditis in interstitial keratitis. (Ricerche cliniche sulle complicanze coroideali nella cheratite parenchimatosa).** *Ann. di Ottal.*, January, 1936.

(3) It is well known that it is often possible to see, when the cornea has cleared after interstitial keratitis, patches of choroiditis, generally in the periphery, but sometimes scattered all over the fundus. It has been a question whether the choroiditis preceded the keratitis or was part of the same process. It is not often that there is an examination made of the fundus before the eye is attacked by keratitis, but there are sometimes cases in which the eyes are not attacked simultaneously, and one may escape entirely. In the hope of throwing light on this point, **Colomba** has examined the eyes of a number of subjects, some of whom had suffered only in one eye; the rest had recovered from the keratitis and had practically normal central vision.

Of the seventeen who had escaped with one eye attacked seven showed no appreciable disturbance of the fundus. The central visual acuity was normal and the visual fields and peripheral acuity were also approximately normal.

Of the other ten, six showed in both eyes small isolated patches of choroiditis, for the most part unpigmented; three showed in the affected eye, in addition to the small patches common to both, large reddish yellow areas covered with abundant pigment; one had escaped all change in the unaffected eye, but the other showed gross changes in the periphery.

All these had normal central vision; the attacked eye showed slight loss of eccentric acuity.

In twelve both eyes had been attacked, of these three had no appreciable fundus change; three showed small foci in the periphery with little pigment, the others showed more gross changes.

In all members of this group the indirect acuity and the visual field were reduced in the sectors in which there was visible choroidal change.

From these and other records, it seems probable that the choroidal change precedes the attack of keratitis, in so far as concerns the small unpigmented patches, but that the grosser change is part of the same process as the keratitis.

HAROLD GRIMSDALE.

II.—GLAUCOMA

(1) **Holst, J. C. (Oslo).—Results of iridencleisis antiglaucomatosa (Holth) in glaucoma simplex in the years 1928-1932.** *Acta Ophthal.*, Vol. XII, p. 348, 1934-35.

(1) Control examinations, after at least one year, were undertaken by **Holst** in 281 out of 534 eyes which had undergone iridencleisis operation at the Oslo University Clinic between 1928-32. It was found that:—

(1) Vision had remained unaltered or had improved in 83·6 per cent.
(2) The field was satisfactory in 96·6 per cent.
(3) The tension had become normal in 75·1 per cent. and could be brought down to normal in a further 15·7 per cent. by the use of a miotic.
(4) Vision, field and tension—taken together—were satisfactory in 68 per cent., or 79·4 per cent. if the group which required miotics is also included.
(5) Cataract could not be demonstrated as a complication of the operation.

Late infection occurred in three cases and sympathetic ophthalmia in one. Cystic scars were present in 17·1 per cent., and posterior synechia in over 42 per cent., this latter without deleterious effects.

ARNOLD SORSBY.

(2) **Vannas, M. (Helsinki, Finland).—Cataract extraction in glaucoma. (Ueber Staroperation bei Glaukom).** *Acta Ophthal.*, Vol. XII, p. 38, 1934-35.

(2) **Vannus** draws on the results obtained during 1921-31 in Elschnig's clinic at Prague in cataract extraction in 62 cases of primary glaucoma and 38 cases of secondary glaucoma. Dividing his material into groups as to whether iridectomy, cyclodialysis, other glaucoma operations and no operations at all had been performed before the extraction, and noting further whether the tension was normal or not, at the time of extraction. The author shows that the best results were obtained in cases of primary glaucoma, particularly in those who had iridectomy performed; as between the previously non-operated eyes are those that had cyclodialysis done, the first group fared the better. The least favourable were those in which the tension was uncompensated before operation. No hypotony was observed in any case, though in a few cases vision kept on failing in spite of the lowered tension following extraction. In more than half the cases the field remained unaffected, but in three the central area became engulfed. In eight

cases tension became increased after operation, but was easily controlled by pilocarpine; in general, extraction influences raised tension so favourably, that the procedure may be regarded as an anti-glaucoma operation.

ARNOLD SORSBY.

(3) **Basile (Naples).—The effect of X-rays in haemorrhagic glaucoma. (Sugli effetti della Roentgenterapia nel glaucoma emorragico).** *Boll. d'Ocul.*, March, 1936.

(3) **Basile** has used X-rays in a number of cases of haemorrhagic glaucoma and has found them useful in small doses in relieving pain. The dose given was 1/6 of that producing erythema. In most cases the intra-ocular tension fell to some extent. In four of the eleven it fell to normal, and remained. Most of the cases had lost all vision, and in these the cessation of pain made it possible to avoid enucleation.

HAROLD GRIMSDALE.

(4) **Woods, Alan C. (Baltimore).—The use of an extract of adrenal cortex in glaucoma.** *Arch. of Ophthal.*, December, 1934.

(4) In January, 1935, Dr. E. M. Josephson advocated the use of an extract of adrenal cortex in the treatment of glaucoma simplex, on the theory that this hormone served to render the capillaries less permeable to the water in the blood plasma. He reported one cure of glaucoma, and claimed to have arrested the advance of progressive myopia by the same treatment. His article attained a considerable degree of publicity and in the journal "Time," there appeared a statement to the effect that Dr. Josephson, Manhattan Eye and Ear Specialist, had at last ascertained the true cause of glaucoma, and could cure it with a drug. **Woods** therefore decided to investigate the effects of this treatment on patients in the Wilmer Ophthalmological Institute. The action of this hormone is not yet fully known, and its injection into normal animals and men has no demonstrable effect on the blood or body tissues. Its repeated injection into an adrenalectomised animal will, however, serve to keep it alive indefinitely, whereas without injections, the animal dies in a state of shock. The extract of the cortex does not of course contain adrenalin. Eleven glaucomatous patients were treated by intramuscular injections of a properly tested preparation with a total absence of any effect on their intra-ocular pressure, or composition of the blood plasma. A twelfth case was treated by intravenous injection of the hormone and again the intra-ocular pressure was not lowered.

F. A. W-N.

III.—CONJUNCTIVITIS

(1) **Harman, Bishop (London).—The prevention of conjunctivitis in children and the social administrative measures to be recommended.** *Medical Press and Circular*, May 20, 1936.

(1) **Bishop Harman's** paper was read before the general assembly of the International Association for the Prevention of Blindness, in Paris, on May 11, and deals with the chief social features of the disease. The evidence cited has been mostly collected in London, but similar has been obtained elsewhere. There are three sources of evidence for the basis of this report:—A large ophthalmic hospital, a children's hospital and the London elementary schools.

From these sources the author concludes that conjunctivitis is greater in infancy than in youth, and in youth than in age; in the poor, the dirty, and the overcrowded, than in those whose conditions of life are relatively clean, comfortable and open; in the early summer months, April-June, than at any other season of the year; and in females than in males.

Both in the children's hospital and at the ophthalmic hospital analysis of the annual returns shows that the peak of incidence is in infancy. The graph shows a sharp fall from birth to the second year and thereafter a steady fall year by year.

The incidence per 100,000 was found to be as follows:—Infancy, 22; school age, 20; young adults, 18; adults, 15; elders, 7. These figures have also been related to a group of eye diseases which occur fairly uniformly in all ages; and here the relative figures of the incidence of conjunctivitis shows a steeper curve:—150, in infants; 110, in school age; 50, in young adults; 35, in adults; and 10, in elders. Exceptions to this general statement were to be found in the curves of blepharo-conjunctivitis, phlyctenular disease and angular conjunctivitis.

An interesting table under the heading "Social influence," gives the figures related to the 'constant' of other diseases among native and alien cases. Here conjunctivitis in natives number 100 to 471 in aliens. For trachoma the figures are 3·4 and 58; for phlyctenular, 3 and 28·4; and for blepharitis, 15 and 126·5 respectively.

As regards cleanliness a table shows 19 cases in 2,174 above the average; 134 in 9,463 average; and 197 in 10,256 below the average.

Fifty clean children examined bacteriologically gave 20 sterile conjunctivae and the same number of dirty children gave only 3 sterile.

Bishop Harman concludes *inter alia* that "the prevention of conjunctivitis can be secured through an improvement in sanitary

conditions and personal cleanliness. The risks of epidemics in resident institutions can be eliminated by the strict rule that toilet articles shall be used only by the person to whom they are issued. The measures for prevention of conjunctivitis can be most effectively applied through the School Medical Service, whereby all children are periodically examined and the necessary treatment arranged. The presence of chronic conjunctivitis such as trachoma is a legitimate ground for the exclusion of immigrants."

The paper is a most valuable contribution towards the public health and should be read, in its original form, by all concerned in the administration of the health services of the country.

R. R. J.

(2) **Wilson (Cairo).—The various forms of conjunctivitis among children in Egypt, etc. General Assembly of the International Association for the Prevention of Blindness and of the International Organization against Trachoma.** Paris, May 11, 1936.

(2) While ophthalmia neonatorum is very rare in Egypt, children hardly commence life before they fall victims to other form of conjunctivitis. This is assisted, according to **Wilson,** by the practice among the poorer classes of instilling into the eyes of their babies a mixture of onion juice and salt, in the belief that this is a prophylactic against eye diseases. As this is done for forty days the conjunctiva is kept inflamed and more susceptible to the implantation of pathogenic bacteria.

In Egypt the principal causes of infectious conjunctivitis are the gonococcus, the Koch-Weeks bacillus, and the diplo-bacillus of Morax-Axenfeld. These may occur in an acute, sub-acute or chronic form. All are endemic throughout Egypt, but the first two show very constant epidemic and seasonal variation.

The diplo-bacillus may be found in conjunctival smears all the year round, and often in children who have no acute conjunctivitis. Few children reach the end of the first year of life without suffering from acute conjunctivitis, the result of infection with the Koch-Weeks bacillus or gonococcus. However, the higher one ascends the social scale the less frequently are the acute ophthalmias met with. The epidemics of ophthalmias which have attacked the inhabitants of Egypt and invading armies from time immemorial have been often described and still constitute a severe menace in the absence of careful sanitary precautions.

Gonococcal conjunctivitis, as has often been pointed out, is not of venereal origin. It is the aetiological variety of conjunctivitis which causes the most damage to the eyes. It may be found in the conjunctival sac months after the initial attack. The author has

found that Koch-Weeks infection is more common in children during the first year of life, but that after this, and up to the age of fifteen years gonococcal ophthalmia is more common. Later Koch-Weeks infection regains its predominance.

The author states the pneumococcus is often found in smears but is seldom the primary cause of the acute ophthalmia. This was not the experience of MacCallan and Sohby as shown in the Reports of the Ophthalmic Section of the Public Health Department for 1919 and 1921, who found that the pneumococcus was considerably more dangerous to the cornea than the gonococcus; they are shown as percentages of cases of ulceration seen:—

	1919	*1921*
Pneumococcus	36·27	51·24
Diplo-bacillus	35·92	24·24
Gonococcus	30·23	27·39
Mixed infection	26·90	30·90

The seasonal variation of the various aetiological forms of conjunctivitis was first studied in Egypt by Meyerhof, and later, with enormously increased numbers of patients to study, by MacCallan, who published graphs showing the relationship of different bacteriological causes of conjunctivitis to the mean maximum atmospheric temperature of Egypt and the relative humidity. These were begun in 1914 and continued until 1921 in the Reports of the Ophthalmic Section. They are approximately similar to Wilson's findings. MacCallan attempted to make a fly census, but failed to do so, owing to the defective fly-traps with which he was supplied. The author gives the results of fly censuses, but does not state if they were obtained by any scientific method or were the results of casual observations.

The incidence of Koch-Weeks conjunctivitis is at its lowest in January or February, the coldest period of the year. Then an epidemic commences, the height of which is reached in May or June, when the atmospheric temperature is rising. After this although the temperature remains high there is a marked falling off in the number of cases until the middle of August, when a new rise begins, which is never so great as the first. From October onwards the cases steadily diminish.

The incidence of gonococcal ophthalmia is low until June, when a check occurs: after which a new and much higher maximum is reached in October, when the temperature has begun to fall. This is a constant phenomenon and was noted both by MacCallan and Meyerhof.

It is thus seen that a certain degree of warmth is required before

the Koch-Weeks epidemic begins, and a still greater degree of heat before the gonococcal epidemic starts. The gonococcus does not resist drying so well as the Koch-Weeks bacillus, so it begins to die off in May with a lessened atmospheric humidity. With increased humidity in September, owing to the rise of the Nile flood, there is an increase both of Koch-Weeks and gonococcal.

The author says that there are two fly-breeding seasons in Egypt, the first begins in March, when the temperature is about 26° C., but the flies die off rapidly when the temperature reaches 35° C. in May. The second fly-breeding season begins in September when the temperature has fallen to about 31° C., and continues till the middle of October.

It is noteworthy that the Koch-Weeks epidemic begins just after the flies begin to increase, and the maximum coincides with the height of the fly-breeding season. The maximum of the gonococcal epidemic coincides with the second fly-breeding season. The summer minimum of Koch-Weeks cases and the August fall in the gonococcal curve coincide with the summer minimum incidence of the fly pest.

It is thus seen that the seasonal epidemics are closely related to the three factors, temperature, humidity and flies.

It is stated in "The System of Bacteriology," published by the Medical Research Council, Vol. VII, p. 247, 1930, "that trachoma does not supervene on a normal conjunctiva, but that some form of inflammatory reaction is necessary before the condition appears." While this is almost invariably true among the poorer classes in Egypt, it is a statement which must be repudiated as of universal application. Every surgeon who has had any extensive experience of trachoma has seen numerous patients who have become infected in the absence of the slightest previous inflammatory affection of the conjunctiva. The reviewer has under observation at the present time two medical men and two females who have undoubted trachoma, but who have never, previous to infection, had any acute conjunctivitis. It is noteworthy that none of them has ever been out of England, and to the best of their knowledge has never been in contact with, nor seen a case of trachoma in their lives. However, there is no doubt that they must have received contagious material from an infected person.

The author is no doubt right when he says that in a country like Egypt the guiding principle in the prevention of trachoma must be the prevention of acute ophthalmias. However, there is no doubt that neither a Koch-Weeks nor a gonococcal conjunctivitis can give rise *per se* to trachoma whether in the presence of adenoidism or any other diathesis.

A. F. MACCALLAN.

(3) **Terrien (Paris).—Classification of conjunctivitis. General Assembly International Association for Prevention of Blindness and International Organization against Trachoma.** Paris, May 11, 1936.

(3) **Terrien** discusses the value of various methods of classification of the different forms of conjunctivitis. He makes several interesting remarks, among which is his statement that phlyctenular conjunctivitis appears to be merely an anaphylactic reaction. Phlyctenular formation is an apanage of youth, of puberty at the latest, which is observed in individuals with scrofula or latent tuberculosis. The tuberculin reaction is always positive. As we know this is not sufficient proof; but an X-ray examination shows the presence of active tuberculous foci in the inter-tracheo-bronchial glands, and the instillation of tuberculin, or simply of irritants, gives rise to phlyctenules only in animals which are tuberculous or which have already received tuberculin injections.

A. F. MACCALLAN.

(4) **Amat (Madrid).—Mercurochrome in ophthalmia neonatorum. (El mercurocromo en la oftalmia neonatorum).** *Rev. Cuban. de Oto Neuro.-Oftal.*, Vol. IV. p. 108, 1935.

(4) **Amat** says that the solution of mecurochrome he uses in ophthalmic practice is in the form of a 4 per cent. watery solution. Dr. Klenfield, of Brussels, uses this solution as a disinfectant for operation wounds, in acute conjunctivitis and in marginal corneal ulcers. The author first used it most satisfactorily for serpiginous ulcers, for sterilisation of the silk used in ophthalmic surgery and for the pre-operative treatment of cataract. He quotes three cases of ophthalmia neonatorum which were completely cured by mecurochrome after the classical treatment with silver nitrate had failed. In two cases the causative organism was the gonococcus, and one of them had a purulent ulcer. The author considers that in all cases of ophthalmia neonatorum caused by pneumococcus, staphylococcus or streptococcus this treatment is vastly superior to that of silver nitrate.

E. E. CASS.

(5) **Selinger, Elias (Chicago).—Local quinine therapy for some diseases of the conjunctiva and cornea.** *Arch. of Ophthal.*, January, 1936.

(5) **Selinger** has found by experiments on animals that the normal conjunctiva and cornea, as well as the traumatised cornea, show no ill effects from the daily application of quinine salts in various concentrations. Clinical experience with over 60 patients gave the same results with daily applications of quinine bi-sulphate in the form of 2 per cent. or 4 per cent. ointment, or the application

of a 10 per cent. solution two or three times a week. The latter is painted on the conjunctiva of the everted lids after instillation of 1 or 2 per cent. butyn or some other suitable anaesthetic, the ointment being applied night and morning at first in 2 per cent. and later in 4 per cent. strength. The effect in trachoma has been to bring about decrease in the hyperaemia, papillary hypertrophy and the degree of corneal opacity, the latter effect being also noted in interstitial and disciform keratitis and in old opacities of the cornea. Quinine therapy has been successfully employed in other forms of hypertrophic conjunctivitis too.

F. A. W-N.

(6) **Gardilcic, A. (Zagreb).—A new trachoma treatment and its result. (Ueber versuche mit einer neuartigen Trachombehandlung und deren Ergebnisse).** *Zeitschr. f. Augenheilk.*, Vol. LXXXVI, p. 121, 1935.

(6) **Gardilcic** recalls that the tears of inflamed eyes lose their alkalinity, but found that treatment with alkalies gave disappointing results. He was more successful with oxydising agents using chloramin, sodium or potassium hypochlorite and Dakin's solution. Good results against trachoma, superinfection and scrofulous complications in trachoma were obtained by the use of a combination of alkali, oxydation and heavy metal, the best being p. Toluolsulfochloramin silver in ointment form. Fuller details are promised in a later publication.

ARNOLD SORSBY.

IV.—MISCELLANEOUS

(1) **Johnson, T. H. (New York).—Homonymous hemianopia: some practical points in its interpretation, with a report of 49 cases in which the lesion in the brain was verified.** *Trans. Amer. Ophthal. Soc.*, Vol. XXXIII, p. 90, 1935.

(1) **Johnson** has carried out a study of the visual field defects associated with certain intra-cranial lesions in order to determine the extent to which homonymous hemianopia, quadrantic and sectoral defects, when correlated with other symptoms of cerebral tumour, could be used for localisation of the neoplasm. Homonymous hemianopia was present in 143 cases which he examined with the perimeter and in 49 of these the cerebral lesion was demonstrated at autopsy.

Five cases of frontal lobe tumour had produced homonymous hemianopia by pressure on the optic tract, in four this field defect was complete and in one incomplete. The author found that neoplasms at the base of the frontal lobe in the early stages produce

symptoms of retro-bulbar neuritis manifesting a central and paracentral scotoma in the ipsolateral visual field and when pressing upon the olfactory lobe altered the sense of smell on the same side. Exophthalmos is common in meningioma of the frontal lobe. The author believes that it is probable that only neoplasms at the base of the frontal lobe produce ipso-lateral optic atrophy and contra-lateral papilloedema.

Neoplasms causing pressure irritation on the second frontal gyri cause conjugate deviation of the eyes to the ipso-lateral side, those which have destroyed the centre by pressure or infiltration prevent conjugate movement of the eyes to the same side. Tumours on the borders of the frontal and temporal lobes may cause pressure effects on the ipso-lateral optic tract thus producing a contra-lateral homonymous hemianopia. When the pressure is not directly upon but adjacent to the visual paths a central scotoma is sometimes found in the ipso-lateral field.

In a series of 28 cases of temporal lobe tumour the author found complete homonymous hemianopia in seven cases and incomplete in 21 cases, three being quadrantic and seven crescentic defects. Papilloedema was present in 21 cases. The field changes appear to be more frequent in cases of temporal lobe neoplasms than when the growth is situated in other parts of the brain. Transitory ptosis, ipsolateral miosis and later permanent pupillary dilatation were noted. In 11 cases of occipital lobe lesion the author found complete homonymous hemianopia in six cases and incomplete in three. Visual hallucinations, flashes of light and mind blindness are associated with occipital lobe lesions. The author comments on the fact that homonymous sectoral field defects indicate a lesion posterior to the chiasma but do not localise it to any specific area. Frontal lobe tumours rarely cause incomplete homonymous hemianopia, and neoplasms situated in the temporal lobe produce these visual field defects more frequently than those in the occipital lobe. Crescentic field defects indicate that the lesion is external to the visual pathway and in the same lateral plane.

At the end of this paper is a brief evaluation of the field changes in cases of homonymous hemianopia.

H. B. STALLARD.

(2) **Balado, M. and Oliva, R. O. (Buenos Aires).—Posterior meningo-encephalocele of the orbit treated surgically. (Meningo-encefalocele posterior de la orbita tratado quirurgicamente).** *Arch. de Oftal. de Buenos Aires*, Vol. XI, p. 3, January, 1936.

(2) **Balado** and **Oliva** describe a case of a boy aged 9 years, who had a meningo-encephalocele.

His general health was perfect and no other abnormalities were

present; he had a past history of two head injuries, one at the age of one-and-a-half years and the other at 3 or 4 years, the second injury resulting in a large haematoma in the temporal region; the mother says the second injury occurred after she had noticed pulsation in the left eye. Soon after birth the parents noticed that the left palpebral aperture was small. At the age of two years they noticed pulsation of the left globe, and some downward displacement; after this there was a slow growing proptosis.

When seen by the authors there was marked facial asymmetry in all diameters, the left side being the larger. The left palpebral aperture was small, and the eye was displaced downwards and outwards and was pulsating, the pulsations coinciding with the carotid pulse. The dimensions of the orbital cavity were enlarged especially vertically. There was some atrophy of the left temporal muscle.

A pulsating mass with well-defined borders was palpated in the left upper lid and orbit.

The right eye was normal in all respects. The left eye had a hypermetropia of 0·5 D. and the vision with difficulty was 2/3; the fundus, tension and visual fields were normal.

On examination by X-ray the left maxillary antrum was seen to be opaque, the floor of the orbit was rarified, and the tumour was invading the antrum.

The whole orbital cavity was considerably enlarged in all dimensions; there was some separation between the frontal and malar bones, and between the great wing of the sphenoid and the frontal plate of the orbital bone.

Under general anaesthesia, a classical incision was made as for the exposure of the chiasma, the frontal lobe was lifted and the tumour was found to be continuous with the temporal lobe of the brain. The membranes were incised and the protrusion pushed back; the enlarged sphenoidal fissure was closed by means of a bony lamina, which was fixed into position by ligaturing the fibrous capsule of the tumour in front of it.

Recovery was uneventful, and when seen nine months later the palpebral aperture was larger, the horizontal axis of the eye had been raised, but there was still some slight pulsation. The visual acuity was still 2/3.

Extensive references to other cases of this condition are given.

The pathology of meningo-encephalocele is still a debatable point. The malformation may begin in foetal life, when it may be due to a defective development of the bones of the skull resulting in a hernia of the brain and meninges, or there may be a premature ossification of the sutures, which upsets the equilibrium between the cranial capacity and the size of the brain. Another foetal theory is that there is a ventricular hydrops,

resulting in a secondary destruction of the bones of the skull. Another theory is that the condition originates in the embryo and there is a lack of development of the cranial membrane.

In the opinion of Berger the condition is a tumour, *i.e.*, encephaloma.

Characteristic of this condition is the appearance of cerebral symptoms due to pressure on the encephalocele. There are also always alterations in the bones of the orbit and face, and there is pulsation of the tumour. The growth is always slow.

The prognosis of this condition is usually very grave, and the majority of cases die. The only possible treatment is surgical, and replacement of the hernia accompanied by plastic operation to repair the bony defects of the orbit is infinitely preferable to excision of the cerebral hernia.

E. E. CASS.

(3) **Hossmann, E. (Hamburg). — Involvement of the ocular adnexa in agranulocytosis. (Ueber einen Fall von Erkrankung der Anhangsgebilde der Auge auf dem Boden einer Agranalocytosis).** *Zeitschr. f. Augenheilk.*, Vol. LXXXV, p. 117, 1935.

(3) **Hossmann** reports the occurrence of eczema of the lids and keratoconjunctivitis in man of 48 years, who a month later suddenly developed acute agranulocytosis. His case is of interest as an earlier observer (Reye) has reported necrotic changes in the lids in this affection.

ARNOLD SORSBY.

(4) **Gasser, O. (Zürich).—On the existence of the hyaloid canal in man and lower animals. (Ueber die Existenz des Canalis hyaloideus bei Mensch und Tier).** *Arch. f. Ophthal.*, Vol. CXXXIV, p. 297.

(4) **Gasser** here records a series of experiments on human eyes and the eyes of pigs and other animals to prove the existence of the hyaloid canal; a solution of carmine or other fluid was dropped on the posterior or anterior surface of the exposed vitreous or injected through the optic nerve and disc.

In pigs' or foetal ox eyes it was easy to demonstrate the presence of a sharply defined axial canal extending through the vitreous from the optic disc to the lens; in eyes of calves or oxen it was much more difficult, and the results were less certain. In adult human eyes it was impossible to show the canal owing to the change in the original structure of the vitreous, but in the eyes of four new-born infants and one child examined it could be seen as a fine straight canal in the vitreous.

This research on a much disputed question was undertaken afresh because of its significance in posterior vitreous detachment (*vide Brit. Jl. of Ophthal.*, Vol. XX, p. 107) and its alleged relation to spontaneous tears of the retina.

THOMAS SNOWBALL.

(5) **de Sanctis (Parma).—The state of the visual fields after operation for detachment of the retina. (Comportamento del campo visivo nel distacco di retina dopo intervento chirurgico).** *Rass. Ital. d'Ottal.*, September-October, 1935.

(5) **de Sanctis** has examined the visual fields of patients who have been successfully operated on for detachment of the retina, under varying illumination; he finds that with reduction of the lighting, there becomes manifest some loss of light sense in the part of the retina which was previously detached. In all his cases, there was even in full daylight, some contraction of the field, generally affecting the detached area, but occasionally concentric.

HAROLD GRIMSDALE.

(6) **Rossi (Modena).—Experiments on the action of compressed air on animals eyes. (Azione dell'aria compressa sugli animali. Modificazioni oculari).** *Rass. Ital. d'Ottal.*, September-October, 1935.

(6) This paper forms part of a study of all the effects of compressed air on animals, undertaken by the Institute of Physiology of the University of Modena. This part, alone, has special interest for ophthalmologists. It is well known that when any animal, which has been for some time in compressed air, is brought suddenly into an atmosphere of normal pressure, it rapidly dies as the results of the liberation of bubbles of gas which have been dissolved under pressure in the blood. These bubbles form multiple small embolisms. The gas is chiefly nitrogen; if to avoid this, the animal is kept in an atmosphere of oxygen under pressure there follow paralyses and death from oxygen poisoning. Since the experiments were conducted on animals, no information about subjective symptoms, such as have been recorded in caisson workers, could be obtained. The physical signs were an increase in the intra-ocular pressure; this was found almost constantly. It was transitory only, receding within 24 hours. Less constantly there was contraction of the pupils. Often the corneal sensitivity was lessened. In a few cases there was slight temporary conjunctival redness and secretion.

HAROLD GRIMSDALE.

BOOK NOTICES

Die Electrophysiologie der Netzhaut und des Sehnerven. By RAGNAR GRANIT. Pp. 98. Copenhagen: Levin & Munksgaard. 1936.

In a recent number of this Journal (January, 1936) the present writer published an account of the discovery and investigation of the electroretinogram ("Erg"), in which the outstanding work of Professor Granit was noticed. The reader is referred to that paper for certain technical terms. The present brochure is an authoritative exposition of the same subject, with somewhat more extensive and perhaps conjectural suggestions as to the significance of the facts. It is a monograph supplement (VIII) of Vol. XIV of *Acta Ophthalmologica*, and in it special attention is directed to the theoretical implications of the flicker method. A short introduction deals with the histology of the retina, the importance of interaction, and the duplicity theory. Stress is laid upon the ambiguity of anatomical structure as the distinguishing feature of rods and cones, and it is wisely pointed out that the presence or absence of visual purple in them is a more valuable criterion. It has always been an unsolved problem what happens to the rods at intensities of light which give rise to photopic vision and at which presumably the visual purple is completely bleached. An interesting experiment by Charpentier (1935) in the Helsingfors laboratory proves that the more complete the bleaching the less do the rods take part in the visual act.

After a résumé following much the same lines as in the paper already referred to, Granit concentrates on the analysis of the results of repeated stimuli and flicker frequency. He is led to the conclusion that there are two types of eye:—the E-eye, characteristic of the cat and rat; and the I-eye, characteristic of the pigeon. Most eyes partake of both characteristics (the E I-eye) such as the frog and owl. The E-eye is essentially a rod eye, the I-eye a cone eye. The E-eye shows:—(1) smaller and slower off-response (*d*), (2) subnormal *b* wave after a dark interval, (3) flicker with subnormal *b* waves of the PII component, corresponding to excitation (hence "E") in the optic nerve, (4) after light adaptation diminution of the *b* waves, with only slightly larger *d* waves; (5) low critical frequency of flicker in the light-adapted eye. The I-eye shows:—(1) larger and quicker off-response (*d*); supernormal *a* wave (PIII negative component) after a dark interval, (3) flicker with *a* waves, corresponding to inhibition (hence "I") in the optic nerve, (4) after light-adaptation larger and more rapid *d* waves, emphasizing the inhibitory character of the retina; (5) high critical frequency in the light-adapted eye.

There can be little doubt that the site of origin of the differences of potential in the Erg is not in the rod and cone layer of the retina, but in the synapses; and there is evidence that when the eye is completely dark-adapted and the rods are laden with visual purple actual inhibition of the cone reaction to light takes place in the synaptic layers.

This monograph embodies one of the greatest advances in neurophysiology, and is of importance not only to ophthalmologists but also to neurologists. J.H.P.

Das Elektroretinogramm Normaler und Hemeraloper Ratten. By G. CHARPENTIER (Helsingfors). Pp. 85. 1936. Copenhagen: Levin & Munksgaard.

In the preceding review of Professor Granit's monograph mention has been made of his pupil, G. Charpentier's observation that complete bleaching of the visual purple by intensive light adaptation leads to total abolition of any electrical response to light in the rat. Charpentier's experiments form the subject of Supplement Monograph IX of *Acta Ophthalmologica*, and in this his research is carried farther by investigation of the reactions of rats which have been made night-blind by a diet lacking in A-vitamin. These experiments show that the size of the *b* curve is a definite indication of the amount of the visual purple present, and completely confirms Tansley's previous estimates by a totally different colorimetric method.

Medical Annual, 1936. Bristol: John Wright and Sons, Limited. London: Simpkin Marshall, Limited. Price, 20s.

The ophthalmological section of this work is again written by Sir Stewart Duke-Elder. It contains a survey of some Russian research work in connection with vitamin C and the aetiology of cataract; certain technical advances in corneo-scleral suturing of the section wound in cataract extraction; bacteriological investigations in conjunctivitis, particularly in connection with virus infections and inclusion bodies; the pre-operative treatment of conjunctival infections by local ultra-violet light preparatory to intra-ocular operations; the therapeutic value of quinine ointment for corneal opacities; acetyl choline injections for central retinal artery obstruction and certain biochemical aspects of glaucoma.

The book is up to its usual high standard, is well produced and contains good illustrations.

Hero Dust. By JAMES KEMBLE, CH.M., F.R.C.S. London: Methuen and Co., Limited. 1936. Price, 6s.

This book contains a series of sketches of the following historical characters:—Mary, Queen of Scots, Epicurus, Catherine the Great,

Milton, Beau Brummell, and Omar Khayyam. These sketches are very well written and show evidence of a great deal of research; and the author, as a medical man, has naturally paid attention to the details of medical interest in his heroes and heroines, and thereby added much to a correct understanding of their various psychologies. He dispels certain popular errors attaching to Epicurus and Omar, and is much to be congratulated on the result of his labours.

In an ophthalmological journal we naturally single out his chapter on Milton and his blindness for discussion. Mr. Kemble's account of Milton is excellent. We see the three periods into which he divides his life, *i.e.*, the first period of the youthful poet, to which period we owe L'Allegro, Il Penseroso, Comus, Lycidas, as well as shorter pieces. The second period during which his blindness was developing shows Milton as the savage, sour, crabbed pamphleteer. In the last period, when totally blind, he goes back to his early poetical love and to it we owe Paradise Lost, Paradise Regained and Samson Agonistes.

Milton's sight began to fail in the left eye in 1644, when he was 36 years of age, and he was quite blind by the year 1652.

Mr. Kemble deals faithfully with the fantastic theories advanced by Sauret and Cabannes, and by Mutschmann, and concentrates on the theory that Milton suffered either from retinal detachment or chronic primary glaucoma. He himself adheres to the view that Milton's was a case of primary glaucoma. He sums up the evidence very fairly. The "iris" seen round a lighted candle is, of course, very suggestive of a glaucoma halo, but it can be seen in such conditions as conjunctivitis, and incipient cataract. Now, in about the year 1655, Milton addressed to his old pupil, Syriac Skinner, the famous sonnet in which he says, his eyes, though three years blind, show no spot or blemish. This rules out I think any lenticular origin for the halo. Another point in favour of glaucoma is the fact that Milton felt pains in his eyes when he began to read. Retinal detachment is, as the author says, usually a painless disease. When Mr. Kemble says that it is unusual for detachment to occur in both eyes, I, frankly, think that he is in error. One of his points against myopia as a possible precursor of detachment is, that so far as is known, Milton never wore glasses. As a young man he was a good fencer, and I agree with Mr. Kemble when he says that there can have been no high degree of myopia present. But Milton might easily have had 3 or even 4 dioptres of myopia without feeling that he must wear glasses. The father of Milton could read without spectacles at the age of 84, whereas his mother had to wear them when she was in the thirties. I do not know if his mother ever became blind. I think not. But, for Milton to have developed chronic primary glaucoma leading to

total blindness at the age of 44 years, would, I consider, tend nowadays to a diagnosis of hereditary glaucoma in his case. All the cases of chronic primary glaucoma which I personally have seen in the young have been cases where there was a family history of glaucoma, and the age of onset in the younger generations anticipated that of the previous ones. I think that the metamorphopsia of which Milton complained is far more suggestive of early detachment than of glaucoma. The fact that a "chink" of sight remained for some months merely shows that the field was not totally lost. At the same time a man who has been totally blind for three years from retinal detachment will usually show some signs of secondary cataract, and Milton showed none, according to his own description, even in the eye that first became blind.

The subject is one on which it is impossible to be dogmatic. Mr. Kemble will, I hope, appreciate the fact that there is perhaps as much to be said in favour of retinal detachment as of primary glaucoma. And I hope he will forgive me if I incline more to the view of the former than the latter.

His book is a most interesting production and should command a ready sale.

The Tadhkirat of Ali ibn Isa of Baghdad. Memorandum Book of a Tenth Century Oculist, for the use of Modern Ophthalmologists. First edition in English, by CASEY A. WOOD. Royal 8vo, pp. 332, with plates and text illustrations. Chicago: North Western University. Price, 8 dollars.

Dr. Casey Wood has followed up his translation of the first printed text-book on ophthalmology, that of Benevenutus Grassus, Ferrara, 1474, which he published in 1929, by a translation of the famous Arabian MS. of Ali ibn Isa, and has thereby conferred another benefit on English-speaking ophthalmology.

The Tadhkirat is regarded as the most original and complete of all the early MS. treatises on ophthalmology, and the translator has had the advantage of consultations with Dr. Max Meyerhof, as well as reference to Hirschberg's many articles on Arabian ophthalmology.

Ali was a Nestorian Christian who practised in Baghdad c. 1000 A.D., and is perhaps better known by the name of Jesu Haly.

The Tadhkirat is composed of three books. The first deals with anatomy and physiology, and is almost entirely based on the Greek teaching of Galen. The second book deals with the external diseases of the eye and makes up the major portion of the present work. The third book deals with internal diseases of the eye.

It is obvious from its perusal that Ali was a first-class clinician for the age in which he lived. Many of his descriptions could hardly be bettered to-day. For instance, in dealing with the

various forms of ophthalmia, he notes that "when, in spite of this treatment, the ophthalmia persists for a long time one may be sure that the lids are the subject of trachoma." This, as Hirschberg says, is an accurate and important clinical diagnosis.

Again, in dealing with pannus, Hirschberg points out that nearly all this important chapter is original with Arabian authors, and is not found in any Greek text-book.

Under the "varieties of Chemosis" Ali gives quite a good picture of ophthalmia neonatorum, as the translator notes; and the account of hypopyon is masterly.

Dr. Casey Wood has placed the last chapter of the third book immediately after the first chapter of Book 2. In this he has been most wise, in our opinion, for the chapter deals with the action and other qualities of ophthalmic remedies. This chapter comprises about 30 pages in the modern book and is a very complete list of plants, minerals, etc., used in ophthalmic therapeutics. It is beautifully illustrated by reproductions from Dioscorides and is a monument to Dr. Casey Wood's erudition.

Not content with local treatment, Ali is careful to insist on the need for general treatment. In fact he pays a great deal of attention to the patient's general health. He advises narcosis in all painful operations. "You must first put the patient to sleep, then evert the lid."

It is a very remarkable thing that general anaesthesia was evidently well understood by the early Arabian surgeons. "Poppy and mandragora and all the drowsy syrups of the world" were part of the armamentarium of these early oculists; and there seems reason to suppose that the sleeping mixture was ordered for inhalation as well as given by the mouth. The Greeks apparently did not know how to evert the lid in cases of foreign body in the conjunctival sac. At any rate they do not describe it, but Ali gives clear directions here and elsewhere as to how to evert the upper lid.

References to a "lost manuscript" occur occasionally in the writings of early Arabian oculists and Dr. Casey Wood, who has been working at the Vatican Library since 1933, was on the look out for MSS. of this description. One day Professor della Vida, who is in charge of Arabic MSS. found a large ophthalmic codex, that had not been described in any catalogue. This turned out to be the "Correct Book on Ophthalmology," by Ibn an-Nafis (1210-1288 A.D.) and its discovery is a matter for congratulation for all concerned.

The publishers have produced a beautiful volume which will repay perusal by all who take an interest in the history of their subject.

NOTES

The late Victor Morax

ON Friday, May 15, 1936, at the conclusion of the Annual Congress of La Société Française d'Ophtalmologie, there was unveiled at the Lariboisière Hospital an oil painting of the late Dr. Victor Morax. This was placed in the entrance hall of the ophthalmological department of the hospital as a memorial to his work at the hospital by his colleagues, and as a mark of regret and affection by his friends.

Speeches were made in his honour by Dr. Magitot, Dr. Coutela, Dr. Coppez and others in the presence of a large audience, which included his widow and family.

Mr. A. F. MacCallan was present to represent the Ophthalmological Society of the United Kingdom.

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The Nettleship Prize

THE Edward Nettleship Prize for the year 1936 has been awarded to Mr. H. B. Stallard for his contributions to ophthalmology during the last three years.

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Royal Society of Medicine, Section of Ophthalmology

THE following officers have been nominated by the Council: *President*, W. H. McMullen; *Immediate Past President*, Ransom Pickard; *Vice-Presidents*, P. H. Adams, A. J. Ballantyne, F. A. Juler, A. D. Griffiths, M. L. Hine, D. Leighton Davies; *Hon. Secretaries*, J. H. Doggart, E. F. King; *Council-Physicians*, T. Grainger Stewart, E. A. Blake Pritchard, W. Russell Brain; *Metropolitan members*, F. W. Law, Arnold Sorsby, J. D. Magor Cardell, L. H. Savin, C. D. Shapland, P. G. Doyne, A. C. Hudson, A. Rugg-Gunn, W. B. Rycroft; *Provincial members*, T. Snowball, Percival Hay, R. Colley, N. P. R. Galloway, T. Harrison Butler, W. E. Heath; *Librarian*, Arnold Sorsby; *Representative on Editorial Committee*, R. C. Davenport.

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The Leslie Dana Gold Medal

THE Leslie Dana Gold Medal "for outstanding achievements in the prevention of blindness and the conservation of vision" has been presented to Dr. John M. Wheeler.

International Organization against Trachoma

A MEETING of the International Organization against Trachoma was held in Paris on Monday, May 11, 1936, during the session of the Annual Congress of the French Ophthalmological Society.

After an introductory address by the President, Mr. A. F. MacCallan, papers were read on the treatment of trachoma in children by Mr. MacCallan, Dr. Wibaut (Holland) and Dr. Zachert (Poland). An interesting discussion followed in which the following took part:—Dr. Ragazzi and Professor Baslini (Italy), Dr. Joseph Jitta (League of Nations), Dr. Aubaret (France), Dr. Nataf (Tunisia) and Dr. Marin Amat (Spain). Reports will be published in a forthcoming number of *La Revue Internationale du Trachome.*

Later, on the same day there was a combined meeting of the International Organization against Trachoma and of the International Association for the Prevention of Blindness, under the presidency of Professor de Lapersonne. Professor Terrien read a paper on the classification of conjunctivitis; Dr. Wilson read an interesting account of conjunctivitis in Egypt; and Mr. MacCallan contributed a report on the relationship between conjunctivitis and trachoma. The reports of Dr. Park Lewis, of the United States of America, and of Mr. Bishop Harman were circulated. Copies of all these proceedings may be obtained from the International Association for the Prevention of Blindness, 66 Boulevard Saint-Michel, Paris, 6e.

FUTURE ARRANGEMENTS

1936

October 6.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

December 1.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *May, 1936.*

TRONCOSA and CASTROVIEJO. Microanatomy of the eye with the slit-lamp microscope.

WESCOTT. Concerning accommodative asthenopia following head injury.

WALKER Treatment of the flat type of separated retina and of macular hole with special devices and modifications.

WOLFE and BLAESS. Seton operation in glaucoma.

ALBERS and SHEARD. The tolerance of light in nonphotophobic individuals.

WRIGHT. Interstitial degeneration of the cornea.

Archives d'Ophtalmologie. *May, 1936.*

TOULANT and MORARD. A case of uveo-parotitis.
MICHAÏL and BENETATO. Researches on the respiration of the optic nerve.
MONBRUN, RÉGNIER and JOURDY. The utilisation in ophthalmology of two new salts of para-amino benzoyl-diethylamino-ethanol (novocaine base): phenylpropionate and isobutyrate.
CUÉNOD and NATAF. New researches on trachoma.
VERRIER. Biological study of the retina of vertebrates.

Revue d'Oto-Neuro-Ophtalmologie. *May, 1936.*

H. and R. BOURGEOIS, LAPOUGE, ROGER, COSSA, CARLOTTI, VINCENT, PUECH and BERDET. Arachnoiditis of the base of the brain.

June, 1936.

H. and R. BOURGEOIS, LAPOUGE, ROGER, COSSA, CARLOTTI, VINCENT, PUECH and BERDET. Arachnoiditis of the base of the brain. (Part 2.)

Lettura Oftalmologica. *March, 1936.*

PERGOLA. Ocular changes in mechanical asphyxia. (Experimental research.)
TREMATORE. Xeroderma pigmentosa and cataract.

April, 1936.

ALIQUÒ-MAZZEI. Cataract from glandular dysfunction of internal secretions.

Annali di Ottalmologia e Clinica Oculistica. *February, 1936.*

CONTINO. Functional loss and damage to the working power of neglected eyes.
POLACCO. "Astral vision."
TROVATI. Clinical and anatomico-pathological contribution to the vascular neoplasms of the orbit.
SMALTINO. Influence of the thickness of the cornea and of the lens on the total refraction of the eye.
SCALINCI. Nosology and therapy in the "Ars probatissima oculorum" of Benevenutus Grassus, medical oculist of the 13th century.

Bollettino d'Oculistica. *April, 1936.*

ALAJMO. Coats' retinitis.
CARAMAZZA. Biologically proved results with Ninni's method using the aqueous or the vitreous taken from eyes of rabbits which have been inoculated with human bacillary tuberculous emulsions.
TRISTAINO. Jensen's juxta-papillary retino-choroiditis.
SALA. Ocular alterations in Paget's osteodystrophia deformans.
DE SANCTIS. Diathermocoagulation in iris prolapse.
RAPISARDA. The behaviour of the pupillary diameter, of the amplitude of accommodation and of the intra-ocular tension in fatigued subjects.
FIORE. Some rare cases of keratoconus complicated respectively with senile cataract and with simple chronic glaucoma.

Archivos de Oftalmologia Hispano-Americanos. *May, 1936.*

DOMINGUEZ. On Gonin's operation for retinal detachment
CASANOVAS. Cystoid degenerations and cysts of the retina.

Revista Oto-Neuro-Oftalmologica. *January-February, 1936.*

AGNELLO. A case of congenital bilateral paralysis of the abducens.